ELECTRICAL REVIEW

FRIDAY
5 DECEMBER 1961

WEEKLY
PRICE 1s 6d

SP

The Library of Congress
JAN 30 1962
Serial Record Copy

SURPLUS
DUPLICATE

An actual phase to-earth fault is applied momentarily and the Tester checks that the prospective fault current of three times the fuse rating can flow.

Model No. 1 for testing single-phase or three-phase four-wire earthed neutral supplies up to 60 amperes. Selected fuse ratings 15, 30, 40 and 60 amperes. Suitable for P.M.E. systems (Protective Multiple Earthing).

Model No. 2 has additional facilities for testing up to 150 amperes, single-phase and three-phase, three or four-wire. Selected fuse ratings 15, 30, 40, 60, 75, 100 and 150 amperes. Suitable for P.M.E. systems (Protective Multiple Earthing).

Please write for List IN.13

SIMPLE ●
SPEEDY ●
SAFE ●

FERRANTI

Phase-Earth Loop Impedance Tester

Ferranti

FERRANTI LTD · MOSTON · MANCHESTER 10 *Tel:* **FAIlsworth 2071**
London Office: **KERN HOUSE, 36 KINGSWAY, W.C.2.** *Tel:* **TEMple Bar 6666**

ECC

MOULDED BREAKERS

When you require

M.V. DISTRIBUTION SWITCHGEAR

permit us to quote you for

MOULDED-CASE AIR CIRCUIT-BREAKERS

We offer you the only complete range

UP TO 800 AMPS

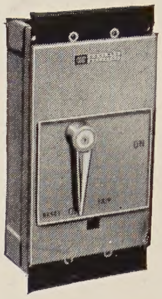
made in the United Kingdom

DELIVERIES mainly EX-STOCK

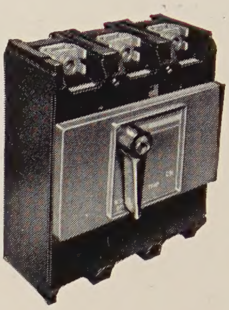
Prices are competitive, even including

THAT PRICELESS EXTRA —

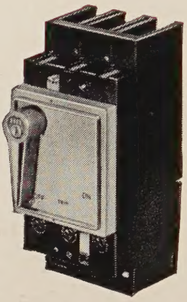
EXPERIENCE



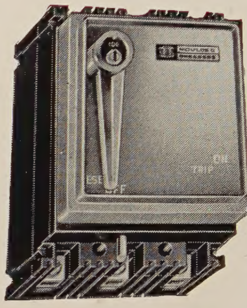
NM 800
125 to 800 AMP



NJL 400
125 to 400 AMP



NFJ 225
15 to 225 AMP



NEF 100
15 to 100 AMP

SAVE

SPACE

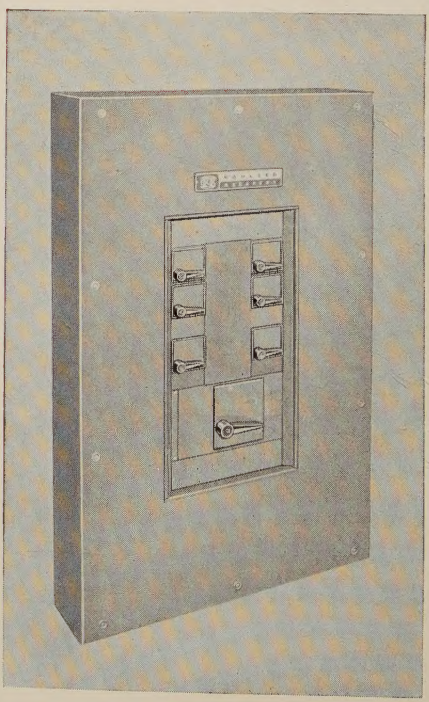
COST

TIME

Height — 60"
Width — 38"
Depth — 9"

AS THIS MV PANEL BOARD So clearly shows

Typical CDPR Assembly with 600 amp NM 3 pole main circuit-breaker, busbars and neutral assembly, together with 1-300 and 1-250 amp NJL 1-150 and 3-70 amp NFJ 3 pole feeder circuit-breakers.



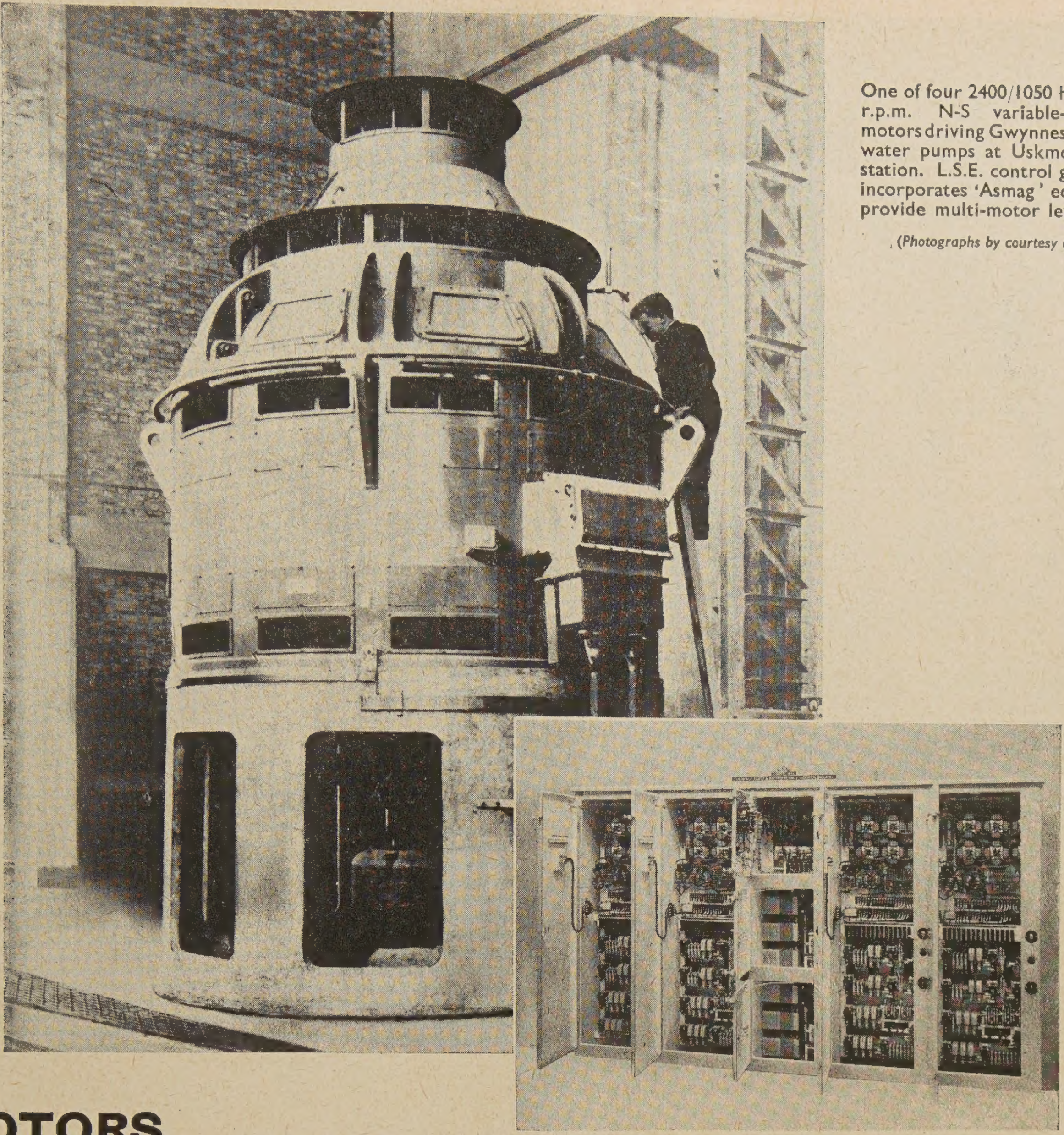
British made to British Requirements

ECC

E.C.C (MOULDED BREAKERS) LIMITED
FORDHOUSE ROAD WORKS · WOLVERHAMPTON

FPE

MB/PA1014



One of four 2400/1050 h.p., 450/345 r.p.m. N-S variable-speed a.c. motors driving Gwynnes circulating-water pumps at Uskmouth power station. L.S.E. control gear (below) incorporates 'Asmag' equipment to provide multi-motor level control.

(Photographs by courtesy of the C.E.G.B.)

MOTORS
and CONTROL EQUIPMENT FOR PUMP DRIVES

Tens of thousands of horse-power of N-S variable-speed a.c. motors, in many instances with L.S.E. automatic control systems, are in pumping service — for water and sewage undertakings, in power stations, and for industrial applications.

Why? Because the stepless variable-speed N-S drive enables output to be regulated most efficiently, without wasteful throttling or dissipation of electrical energy, and lends itself to integration into any automatic control scheme.

Many of these motors are of considerable size, but the advantages of the N-S motor are not confined to large outputs. In numerous instances, motors of comparatively low rating (50 h.p. or less) have enabled the most economical water pumping or sewage treatment plant to be realised.

The outstanding features of the N-S variable-speed a.c. motor, especially when allied to suitable control equipment, are proving of value in almost every industry and have enabled new production techniques to be developed. If you are not fully aware of the possibilities of this machine please ask for further details (preferably mentioning the type of application you have in mind).

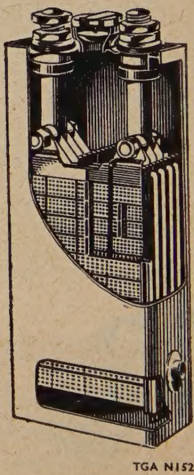
LAURENCE, SCOTT & ELECTROMOTORS LTD.

Specialist Makers of Electric Motors and Control Gear since 1883 NORWICH NOR 85A

RAPID RECOVERY

EVEN after periods of intense activity NIFE Steel Alkaline Batteries instantly recover their voltage and are ready for more work.
This is a tremendous advantage in switching, starting and emergency applications where batteries have to provide heavy discharges either simultaneously or in rapid succession.
NIFE batteries will hold their charge during long periods of inactivity. They do not deteriorate when standing by, but deliver full power whenever it is demanded.
High rates of charge and discharge will not harm them.
Since they need so little attention, and require no separate battery room, NIFE batteries reduce building, installation and maintenance costs.

Far-sighted engineers specify them for SWITCH CLOSING · SWITCH TRIPPING
EMERGENCY LIGHTING · STANDBY POWER FOR AUXILIARIES AND CONTROL CIRCUITS
PORTABLE SAFETY LAMPS · TELECOMMUNICATIONS



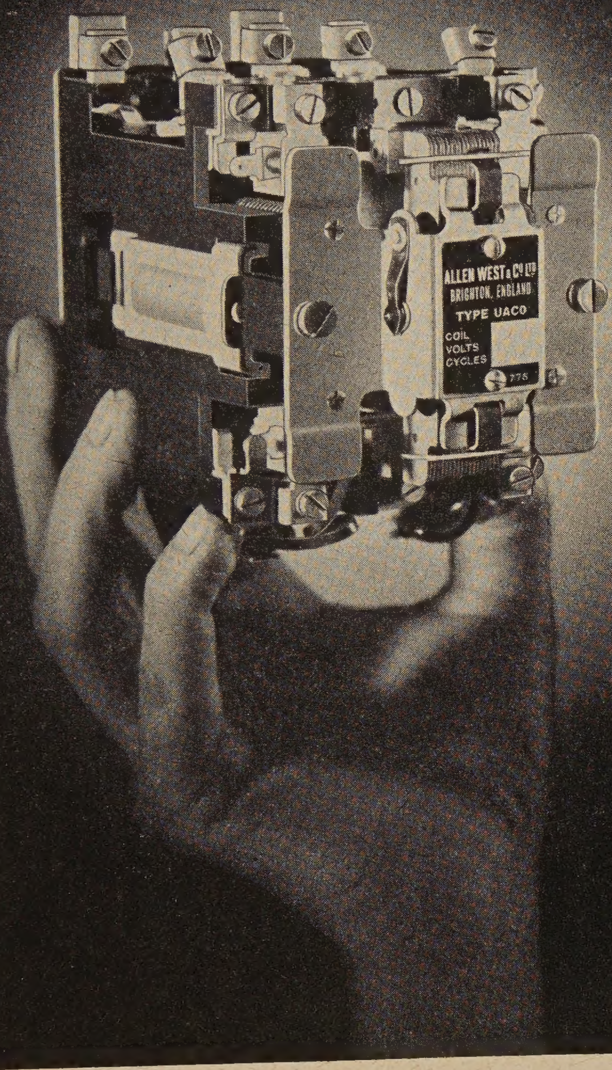
FIT FOR A LONG LIFE

NIFE

STEEL ALKALINE BATTERIES

NIFE BATTERIES · REDDITCH · WORCESTERSHIRE

TGA N152



CAPACITY IN HAND

In keeping with the Allen West tradition, this new range of unit contactors, Type UAC, has that significant extra, ***capacity in hand,*** the fruits of 50 years' experience with electric motor control gear in all fields. Here is more than mere compliance with specification: here is a new high standard in workmanship and performance.

- Double-break silver-faced main and auxiliary contacts
- Four electrical interlocks as standard
- " Clip-on " body for instant access; renewable without disturbing wiring
- Specially designed arc chambers to give ample breaking capacity

15A and 25A sizes now available ex stock
Write for descriptive leaflet 177/A/1-27

ALLEN WEST

ALLEN WEST & CO LTD BRIGHTON ENGLAND · Telephone: Brighton 66666 · Telegrams: Control, Brighton
Engineers and Manufacturers of Electric Motor Control Gear and Switchgear
SUBSIDIARY COMPANIES IN CANADA, SOUTH AFRICA AND RHODESIA . AGENCIES THROUGHOUT THE WORLD

drawing of a

man drawing wire

CONNOLLYS' WINDING WIRE

(of course)

Connollys' fine enamelled winding wires have been specially developed to meet every exacting requirement of the designer and coil winder, and have become famous in the world of electronics and electricity for their toughness, versatility and complete dependability.

To prove that we're not completely hay-wire, a free copy of each of our latest publications will gladly be sent on request.

CONNOLLYS (BLACKLEY) LTD

The largest manufacturers of fine enamelled wire in the world.

Head Office: **KIRKBY INDUSTRIAL ESTATE, LIVERPOOL.**

Telephone: SIMonswood 2730. Telex No. 62 - 247
Telegrams: Syllonnoc, Liverpool - Telex

Stocks held at our Branch Offices and Stores at:-

LONDON	EUSton 6122
BIRMINGHAM	VICtoria 4991
AYCLIFFE	AYCliffe 2202
GLASGOW	MERrylee 9313

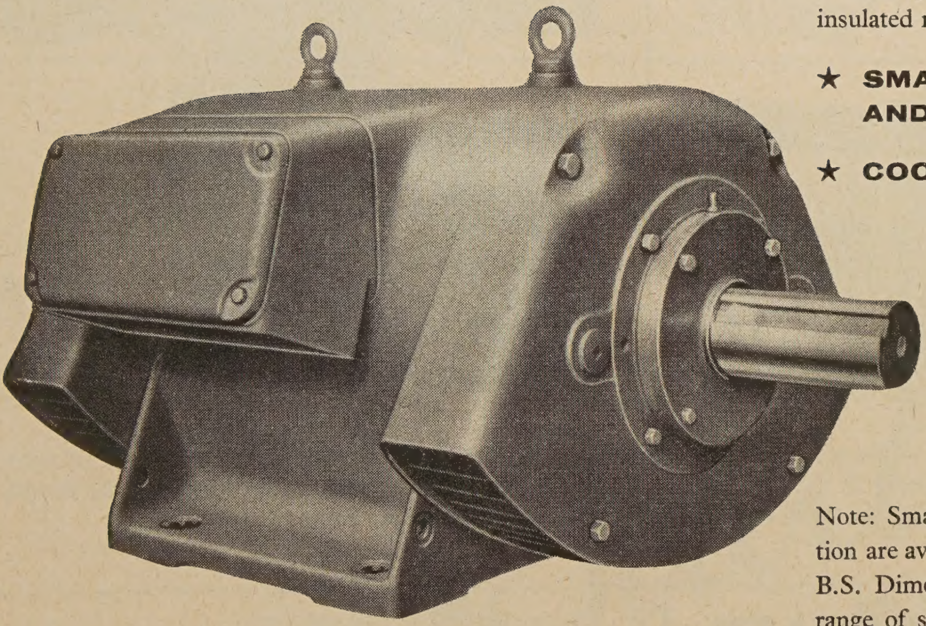
CW 12

80-285 h.p. motors with Class 'E' Insulation

A new range of induction motors—
squirrel-cage, Type NC
and slip-ring, Type NW

Class 'E' insulation permits a temperature rise of 65°C in accordance with BS 2613/1957 and compared with conventional class 'A' insulated motors, these new machines have:

- ★ **SMALLER OVERALL SIZE AND COST** *for a given rating, with*
- ★ **COOL OUTER CASING**



available for
early despatch

Note: Smaller motors with class 'E' insulation are available in the range 1-75 HP, with B.S. Dimensions. Also available is a wide range of suitable control gear.

for further details send for publication 3512-1

AEI

Motor and Control Gear Division
Associated Electrical Industries Limited
RUGBY AND MANCHESTER

A5533

SMITHSONIAN
INSTITUTION DEC 29 1961

DORMAN

DISTRIBUTION FUSE BOARDS

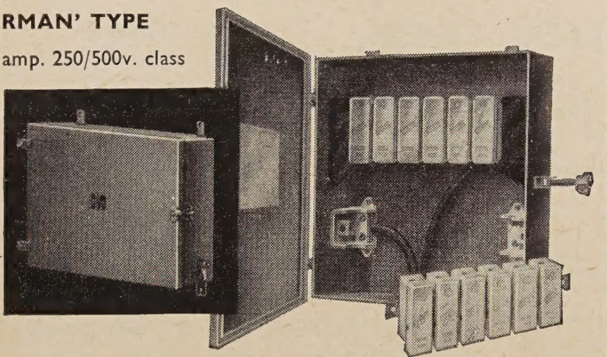
We manufacture two patterns of Distribution Fuse Boards—'Industrial' and 'Flowline' for 0/100 amps. 250/500v. S.P. & N. D.P. T.P. and T.P. & N.

The standard finish is 'hammered' grey enamel. Where special protection is required boards can either be galvanised or treated with a special zinc spray finish.

INDUSTRIAL PATTERN

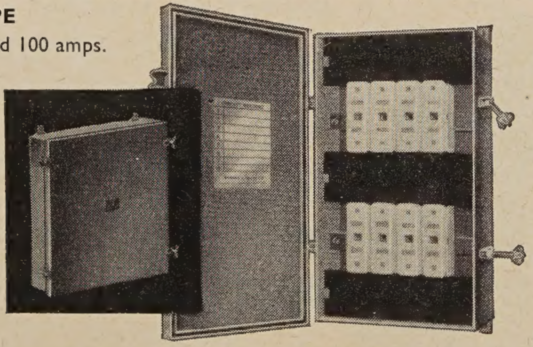
'DORMAN' TYPE

0-30 amp. 250/500v. class



'ASC' TYPE

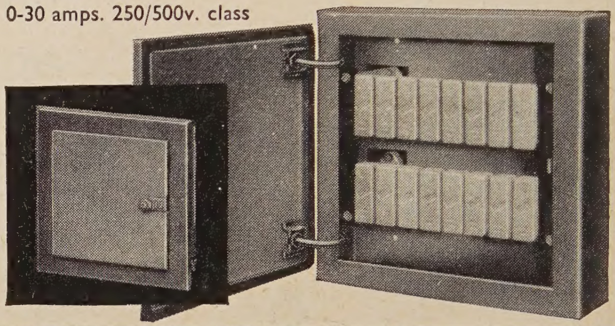
15/30, 60 and 100 amps.
500v. class

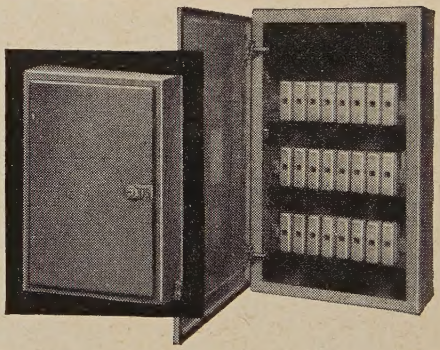


FLOWLINE PATTERN

'DORMAN' TYPE

0-30 amps. 250/500v. class





'ASC' TYPE

15/30, 60
and 100 amps.
500v. class

Both 'Industrial' and 'Flowline' pattern boards can accommodate from 4 to 12 ways and are supplied up to 100 amp. rating for S.P. & N., D.P. T.P. and T.P. & N. circuits. Our range of Distribution Fuse Boards is of compact design, reasonably priced, and has many distinctive features. Fully illustrated catalogue available on request.

DORMAN & SMITH LTD.

PRESTON Preston, Lancashire
Tel.: Preston 86785 (6 lines)

LONDON 125 High Holborn, W.C.1
Tel.: CHAncery 6431

BIRMINGHAM 2/3 Graham Street, Birmingham 1
Tel.: CENtral 2009

GLASGOW 73 Robertson Street, Glasgow, C.2.
Tel.: CENtral 2479

To DORMAN & SMITH LTD.,
Preston, Lancashire.

Please send latest Dorman Distribution Fuse Board Catalogue.

NAME ....

POSITION ....

FIRM ....

ADDRESS ....

ER/15/12/61

DUST

CONTROLLED
AND
COLLECTED

Using the
most advanced forms of
collectors, which include
Electrostatic Precipitators,
High-efficiency Cyclones,
Textile Filters and Wet Scrubbers,
the highest efficiency is given

by
Sturtevant
PLANT

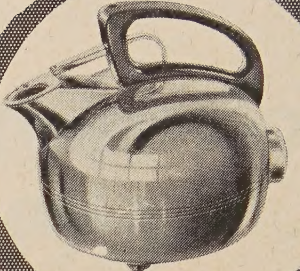
Enquiries to our reference Z/101/U

STURTEVANT ENGINEERING CO. LTD., SOUTHERN HOUSE, CANNON STREET, LONDON, E.C.4

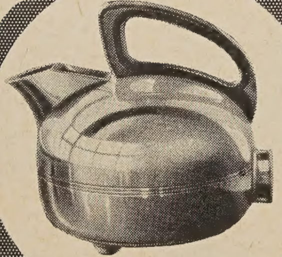
AUSTRALIA: STURTEVANT ENGINEERING CO. (AUSTRALASIA) LTD., MILLER ROAD, VILLAWOOD, N.S.W.

Regal

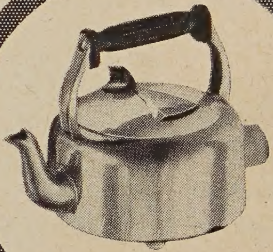
Royal


Siren

For *Top Speed* Selling...

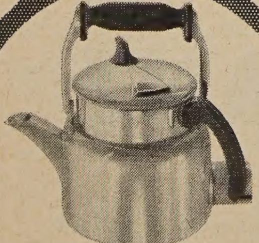

Swift

Popular Chrome


Popular Aluminium

Sell SWAN BRAND electric kettles

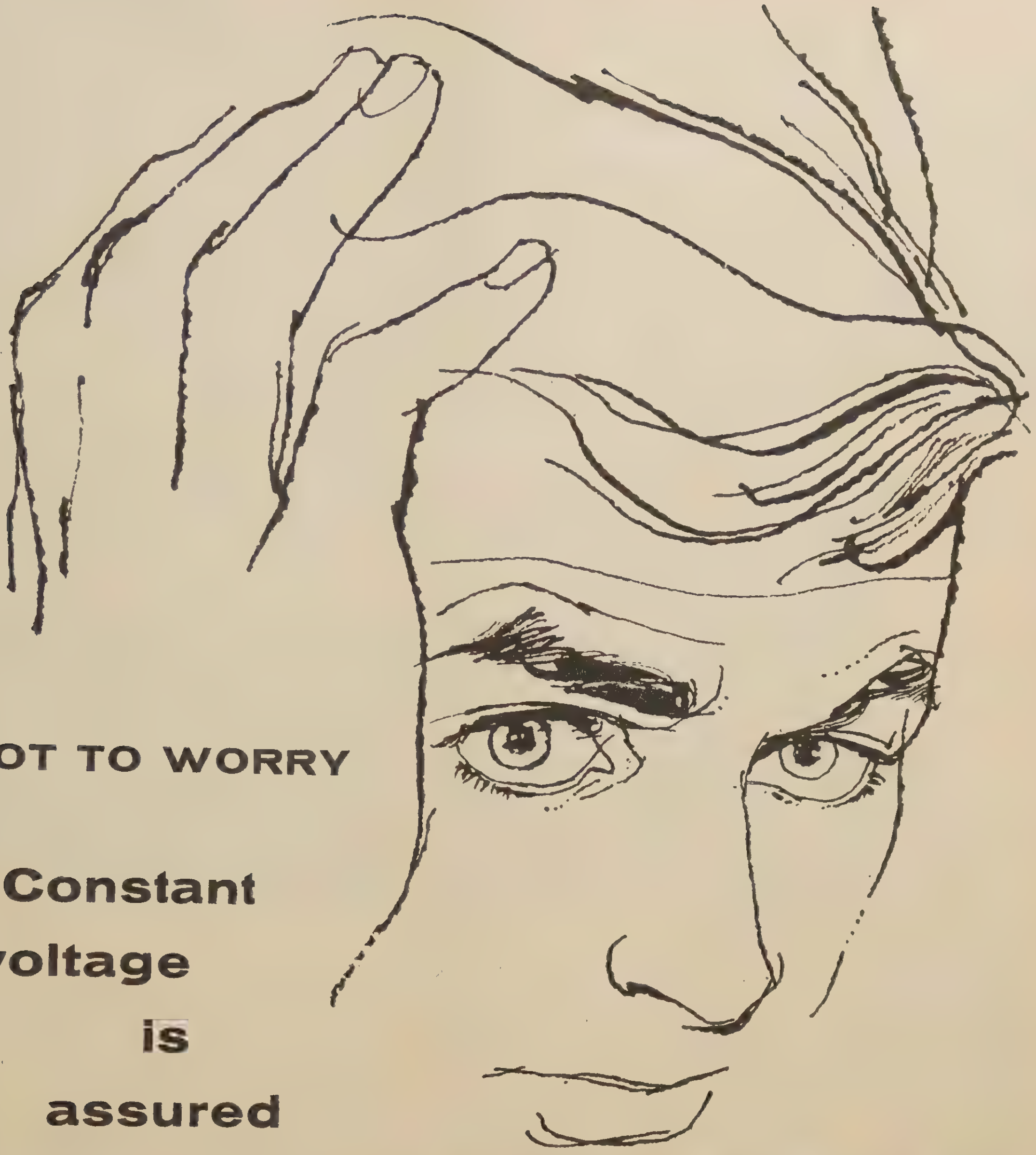
and appliances


Combined kettle and Saucepan

BULPITT & SONS LTD.,
ST. GEORGE'S WORKS,
BIRMINGHAM 18

Jug

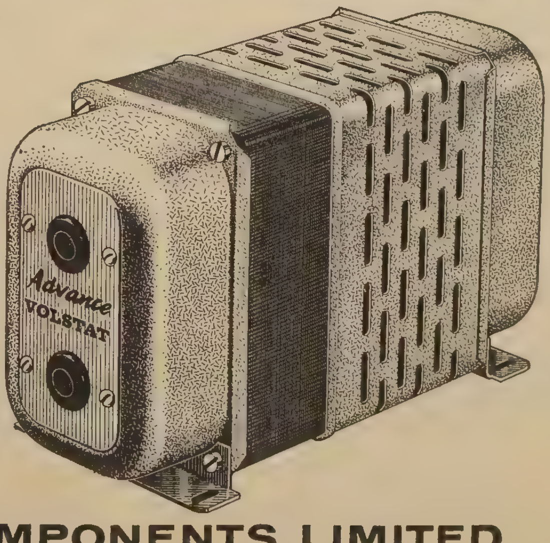
H-W.505



NOT TO WORRY

Constant voltage is assured with a

VOLSTAT



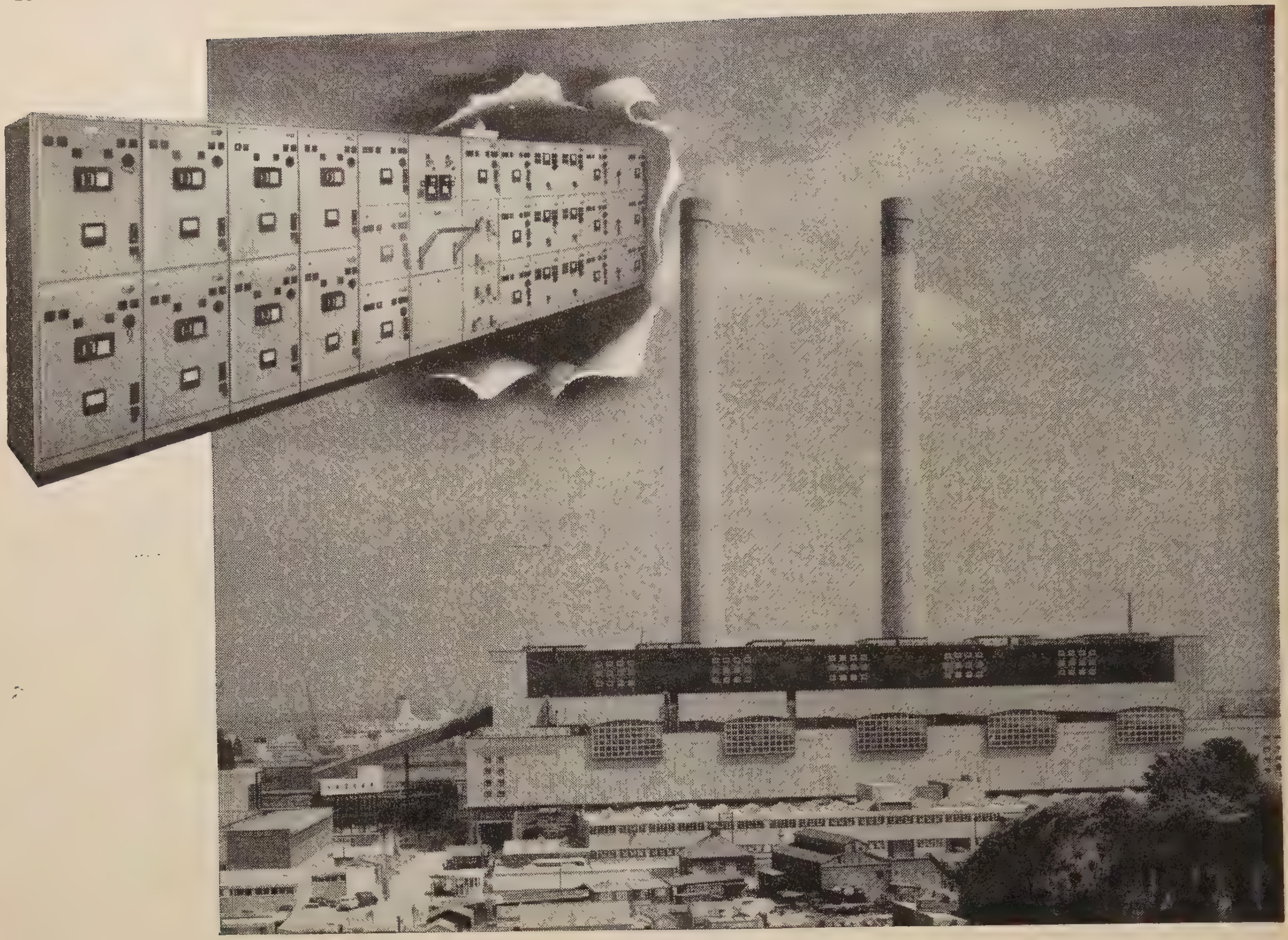
A VOLSTAT is the answer to many a.c. voltage fluctuation problems. In most cases, a standard type is all that is required—but there are occasions when a special design may be necessary. Either way an 'Advance' Technical Representative will be pleased to investigate your own particular problems, and recommend a VOLSTAT best suited to your needs. VOLSTAT stands for a complete range of Constant Voltage Transformers produced by 'Advance'—the leading authority on voltage stabilization.

Full details in Folder D63 available on request.

Advance

COMPONENTS LIMITED
MAINS STABILIZATION DIVISION
ROEBUCK ROAD • HAINAULT • ILFORD • ESSEX • HAINAULT 4444

SBCV/I.



NORTHFLEET POWER STATION

THE CENTRAL ELECTRICITY GENERATING BOARD entrusted to us the contract for manufacturing and installing a wide variety of Switch and Motor Control Boards for the Main Coal Handling Plant, Boiler and Turbine Auxiliaries and Pumps, etc., for the first three Generating Sets in this New Power Station.

The Switchboard illustrated above is one of three controlling the Boiler Auxiliaries. They are flush fronted cubicle type, incorporating All-Isolating features, having hinged "Lift-Off" doors with Plug-in connections. Each compartment is totally enclosed and complete with separate Automatic Shutters (lockable) over main and secondary fixed isolating contacts.

ELECTRO MECHANICAL MANUFACTURING CO. LTD.

Head Office and Works: Eastfield, SCARBOROUGH
Telephone: Cayton Bay 441/2

London Office and Showroom: 133-135 Grand Buildings, Trafalgar Square, LONDON, W.C.2
Telephone: Whitehall 3530

Subsidiary of Yorkshire Switchgear and Eng. Co. Ltd.

something's cooking!...

Something's always cooking at DELANCO. They are always trying to improve on perfection.

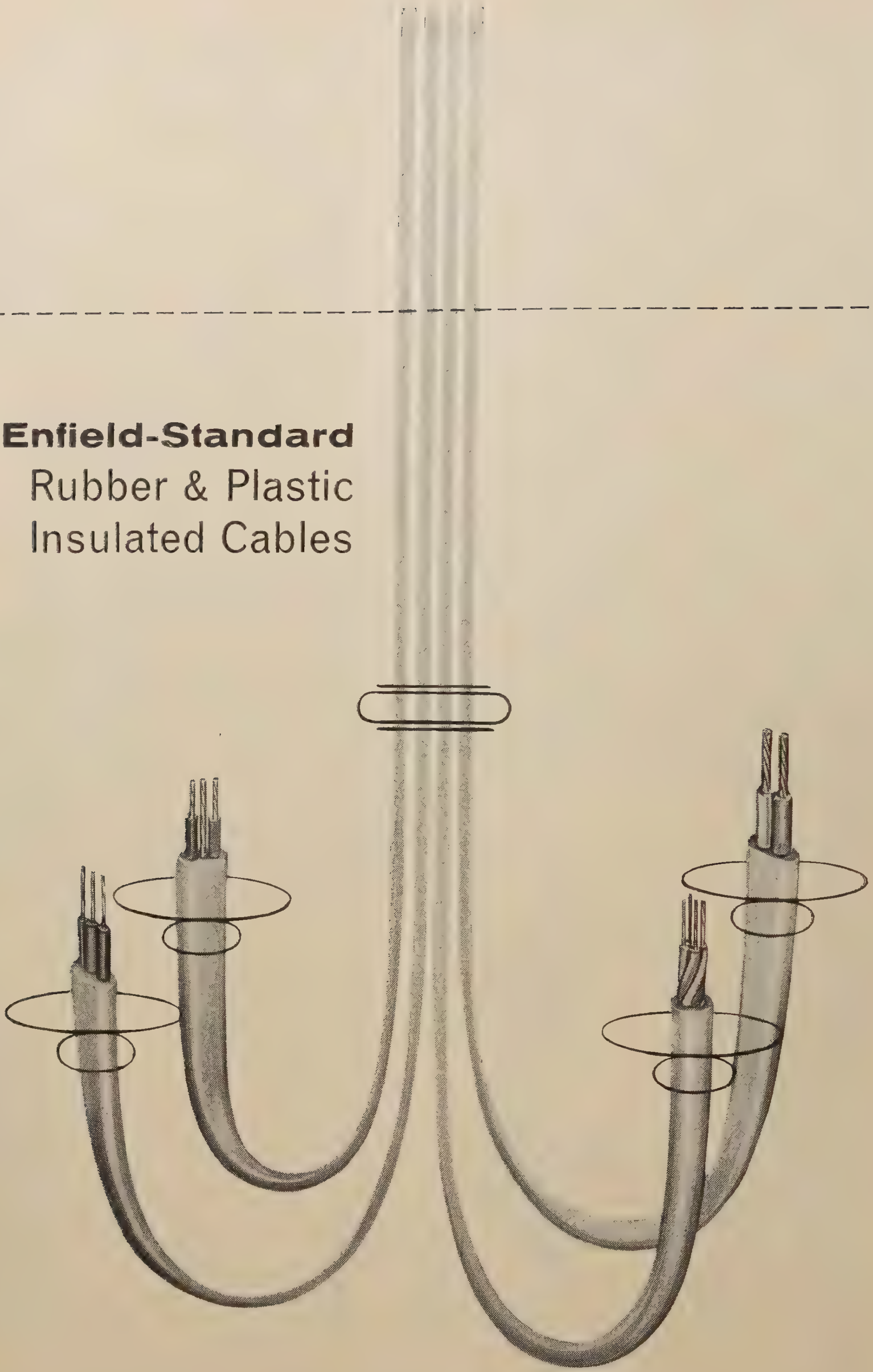
On this occasion they are investigating a complaint regarding the canteen tea, but this same team of Delanco experts are more seriously engaged most of the time in improving the performance and quality of Delanco brand insulation materials for the electrical and engineering industries.

Considering the wide range of Delanco products and the constant demand for something super-plus in performance, it is astonishing how often they come up with the answer.

If your problem is connected in any way with electrical insulation—Bakelite Tubes; Sleevings; Tapes; Machined, Pressed and Formed Components—just ring us, or write and our technical staff will go into action. Materials used under the Delanco trade mark are *Bakelite · Vulcanized Fibre Leatheroid · Presspahn · Glass Fibre · Copper Clad Bakelite and, of course, Delanco Mica.*

DEPENDABLE
Delanco
for Electrical Insulation
Anglo-American Vulcanized Fibre Co. Ltd.,
Cayton Works, Bath Street, London, E.C.1.
CLE 8484. Grams: Prompserv, Cent, London.
Delanco Works, Leonard St., London, E.C.2.

Enfield-Standard
Rubber & Plastic Insulated Cables



Enfield-Standard Power Cables Limited

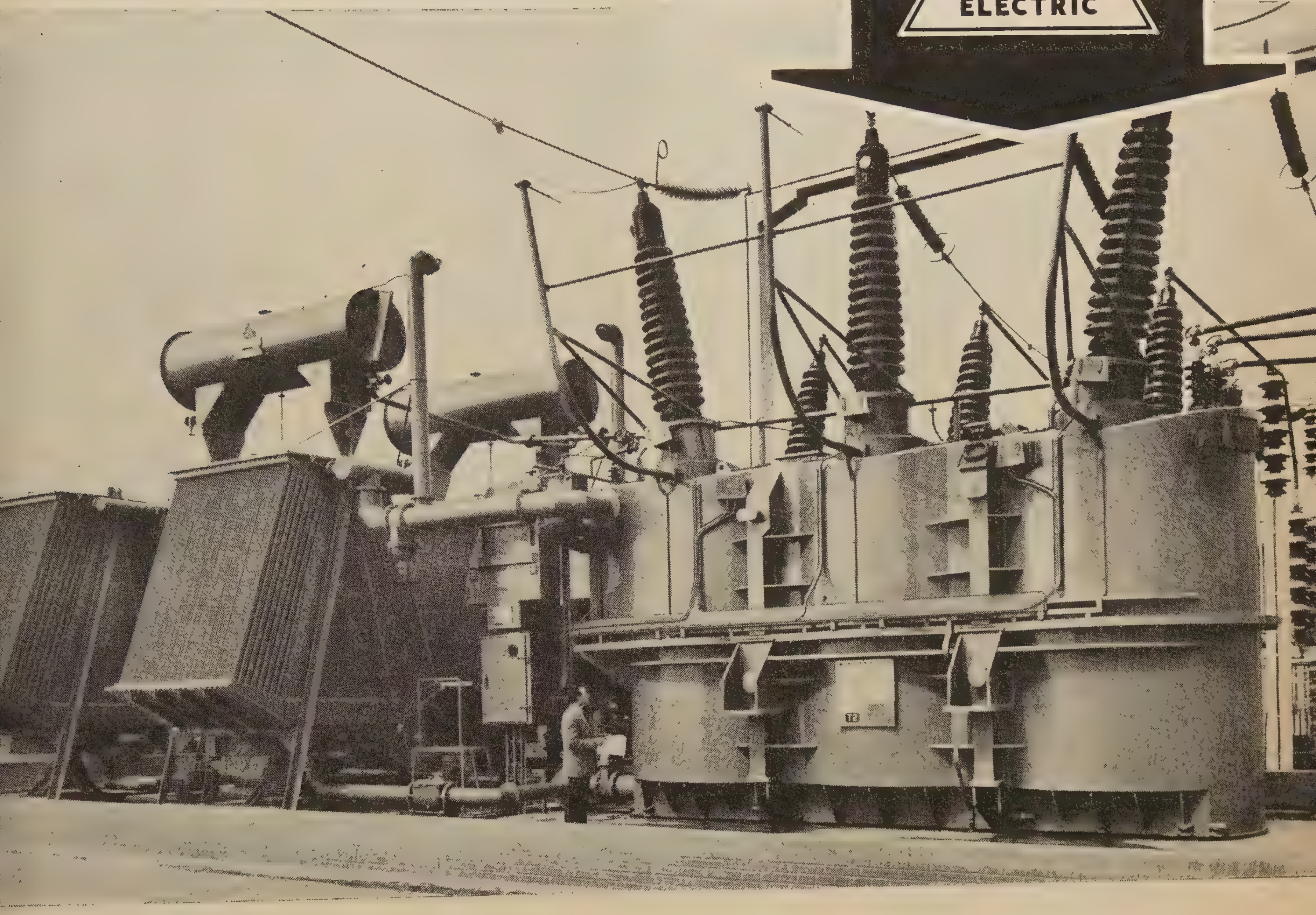
Head Office and Works:

BRIMSDOWN · ENFIELD · MIDDLESEX · TELEPHONE: HOWARD 2468

ONE OF THE TWO RECTIFIER TRANSFORMERS erected at the Central Electricity Generating Board Terminal Station of the Cross-Channel D.C. Power Link at Lydd, Kent. These units are rated at 95/95/65 MVA 284/83·6/33kV and are believed to be the LARGEST RECTIFIER TRANSFORMERS IN THE WORLD.

CONSULT

FULLER
ELECTRIC

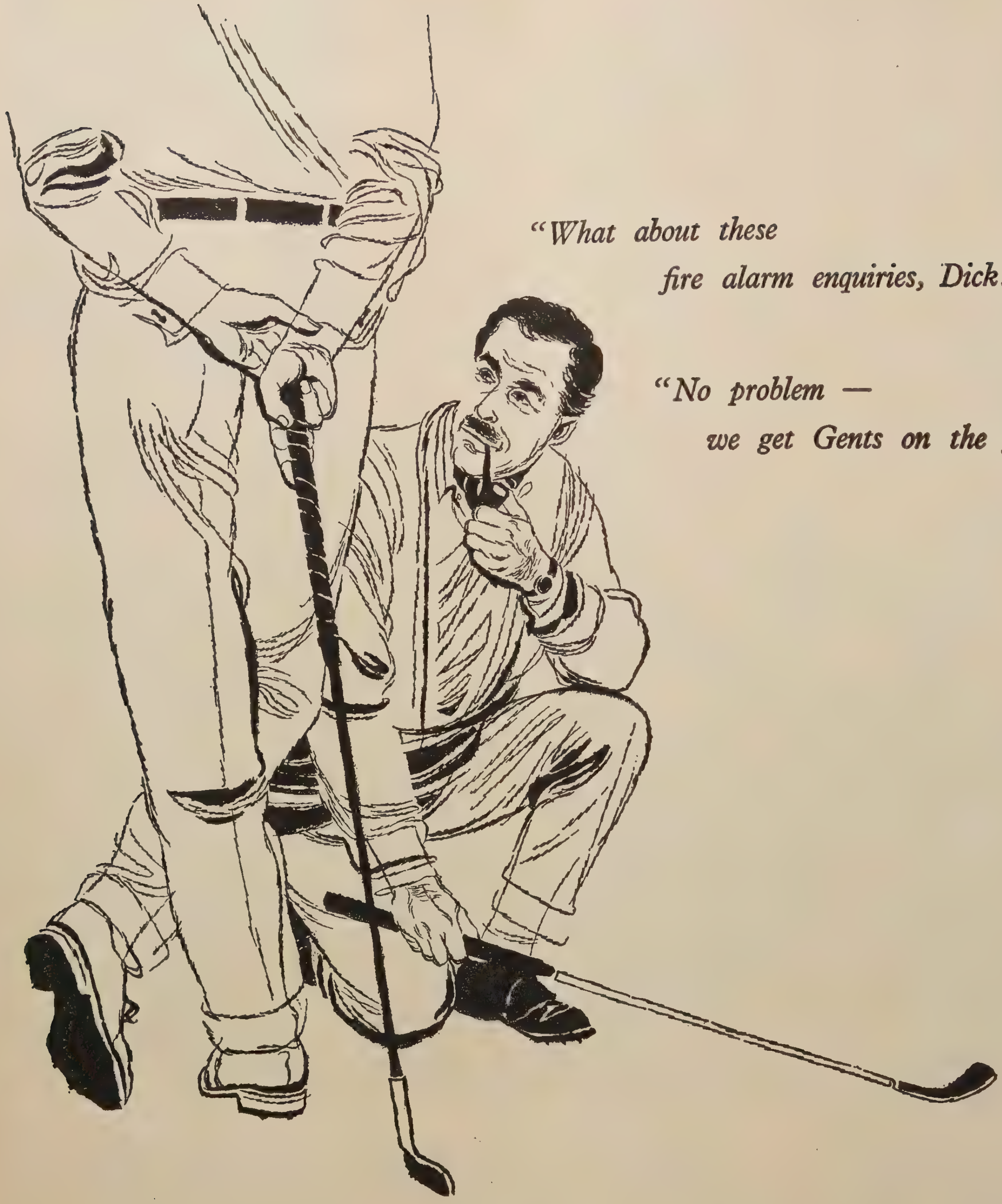


TRANSFORMERS

Modern plant and more than forty years' experience ensure that we are particularly well-equipped to manufacture transformers up to the largest sizes and the highest voltages. Manufacture is under our own control from the earliest possible stages. We build all our own tanks. Winding copper is paper wrapped in our special humidity controlled shops. Windings up to the largest sizes are treated in our 200-ton coil pre-shrinkage press. Other up-to-date equipment includes a 7,000 cu. ft. vacuum drying chamber and comprehensive plant for routine and impulse testing.

FULLER ELECTRIC LTD. FULBOURNE RD · LONDON E17 · Tel: LARkswood 2350 · SOLE UK REPRESENTATIVES FOR ASEA SWEDEN

A MEMBER OF
HAWKER SIDDELEY INDUSTRIES

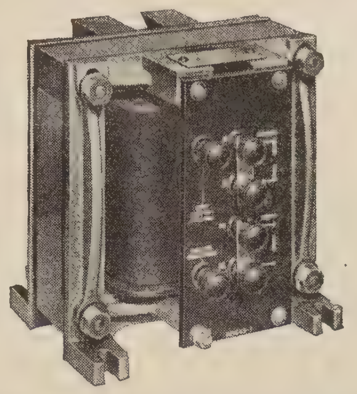

"What about these fire alarm enquiries, Dick?"
"No problem — we get Gents on the job."

GENTS OF LEICESTER **fire alarms — don't give fire a chance!**

Experience counts . . . Gents have had over sixty years in the fire alarm business and make equipment ranging from simple manually-operated systems complying with the Factory Act to comprehensive detector systems, approved by the Fire Offices' Committee, that give the alarm automatically — *day or night.*

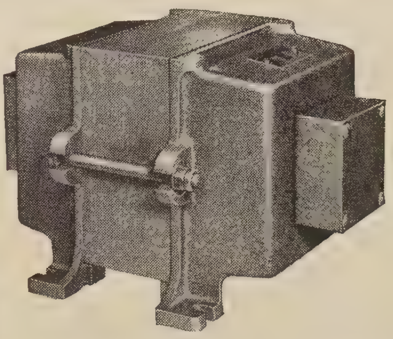
GENT & COMPANY LIMITED · FARADAY WORKS · LEICESTER · London Office and Showroom: 47 Victoria **Street, London S.W.1.**
ALSO AT: BIRMINGHAM · BRISTOL · EDINBURGH · GLASGOW · NEWCASTLE · BELFAST

ZENITH



RELUCTANCE...

is observed only by our choke designers. It is not evident in our desire to satisfy your request, be it one of design or service. You will find us unfailingly helpful especially when your problem is the "one off" unusual design, which a standard production will not resolve. We take pride in being one of the few today who are anxious to consider such matters.



Transformers & Chokes

Unlike most other ZENITH products, Transformers and Chokes cannot be catalogued. The diversity of windings our customers demand precludes any such literature.

Having arranged the production unit to meet the call for those special single items and short runs, we welcome enquiries from engineers confronted with such a situation.

Single phase and three phase Transformers, both A.N. and O.N., can be supplied within the range 5 VA up to 35 kVA at attractive prices.

Automatic Voltage Regulator

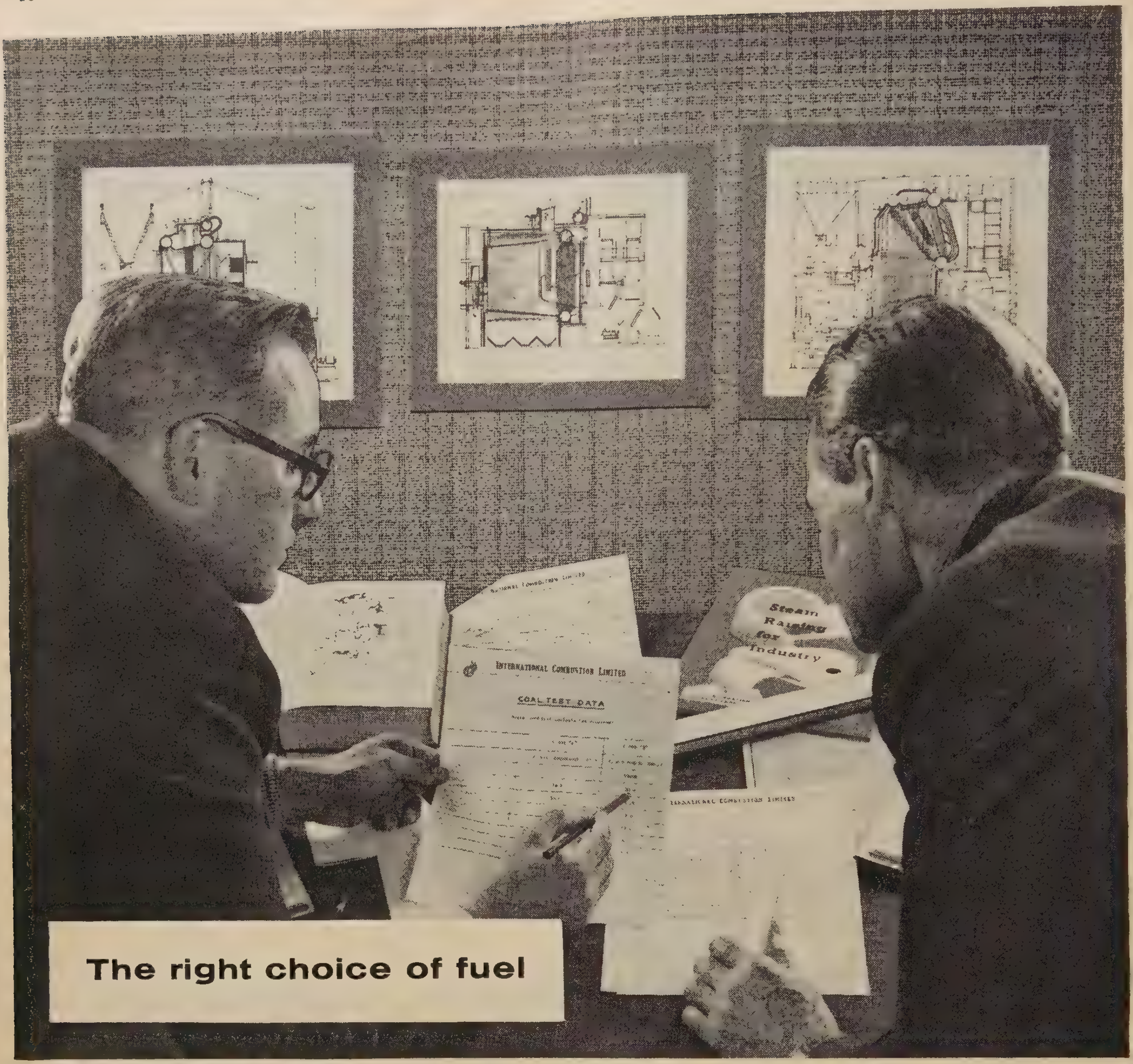
ZENITH Automatic Voltage Regulators incorporating our VARIAC Continuously-Adjustable Transformer are available for single and three phase supplies. The outputs are stabilised at ±1% irrespective of loads within their rating.

There is no measurable wave form distortion under any condition of load and power factor up to the rated capacity, and the sensing device remains insensitive to frequency variation between 45 and 60 cycles.

Single phase outputs 6 kVA to 21·25 kVA; three phase outputs 18 kVA to 64·8 kVA.

Catalogue AVR.3 gladly sent on request.

THE ZENITH ELECTRIC COMPANY LIMITED
ZENITH WORKS · VILLIERS ROAD · WILLESDEN GREEN · LONDON N.W.2
Telephone: WILLESDEN 6581/5 Telegrams: "VOLTAOHM, LONDON N.W.2"



Early planning ensures economic, efficient and effective boiler plant

Right at the outset, when new boiler installations have to be considered, consultation with IC boiler engineers helps to resolve the problems of selecting the most suitable plant.
The importance of early discussions about boiler plant cannot be over emphasized. Selection of operating conditions, boiler output, the choice of fuel, method of firing, and the site limitations, are but a few of the basic problems which can be resolved by early planning.
Take advantage of this IC service, backed by world-wide experience, design, research, manufacturing, and installation facilities.

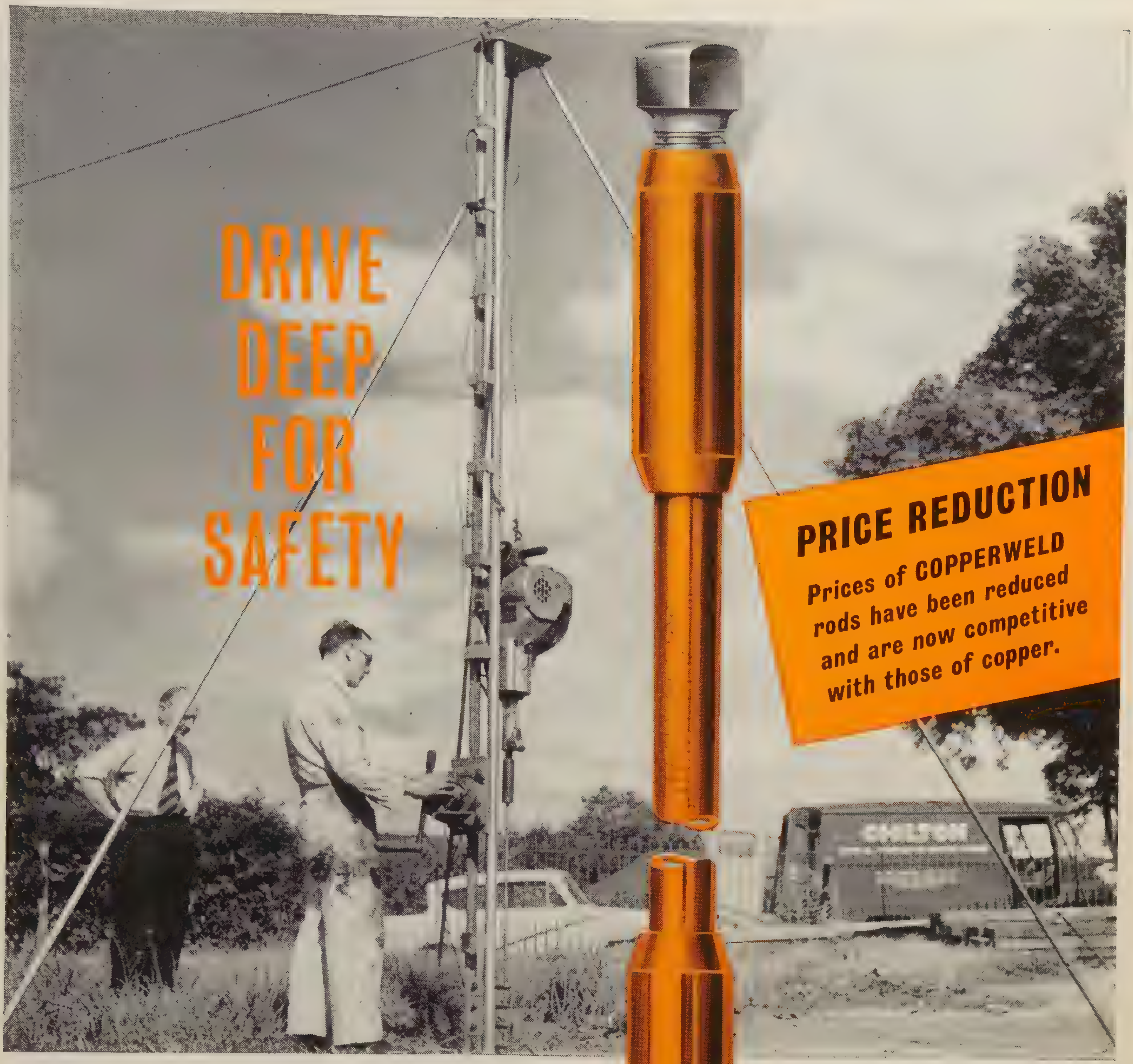
IC

INDUSTRIAL WATERTUBE BOILERS FOR OIL, GAS OR SOLID FUEL FIRING

INTERNATIONAL COMBUSTION LIMITED

NINETEEN WOBURN PLACE LONDON WC1 TELEPHONE TERMINUS 2833 · WORKS: DERBY

I.B.I.



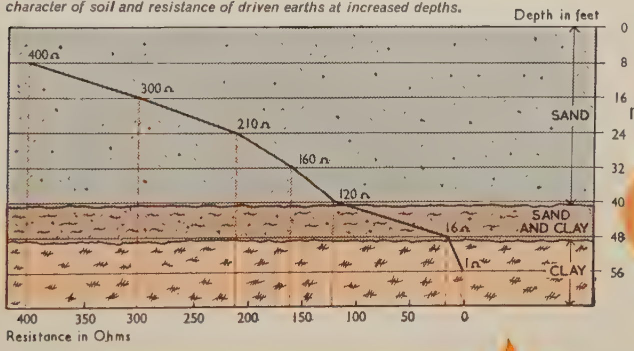
DRIVE DEEP FOR SAFETY

PRICE REDUCTION

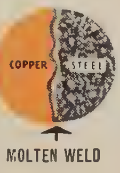
Prices of COPPERWELD rods have been reduced and are now competitive with those of copper.

with CHILTON COPPERWELD SECTIONAL EARTHING RODS

Deeper grounds, lower resistance. This chart shows relation between character of soil and resistance of driven earths at increased depths.



The only molten-welded earth rods

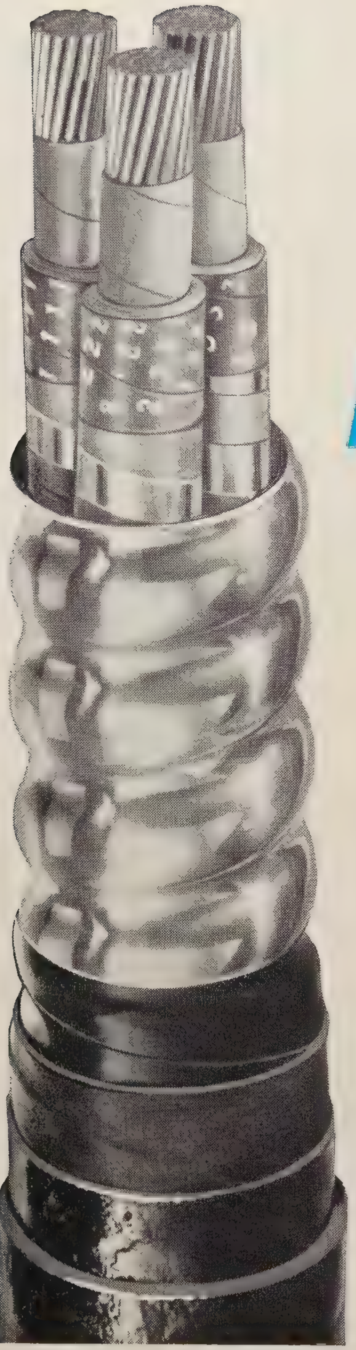


Drive your Earthing Rods deep into the ground if you want to be sure of safe earthing. In many areas the low resistance soil is at a deep level which cannot be reached by rods of standard material. Copperweld Sectional Earthing Rods can easily be driven to depths of 40 feet or more if necessary, with remarkable reduction in earth resistance. These sectional rods have a tough steel core to withstand driving, and a thick molten-welded copper coating for electrical conductivity which also eliminates corrosion. A single Copperweld deep-earth electrode is cheaper than multiple earth rods, occupies less space and is more efficient.
Publication TL 14ER giving full information supplied on request.

Chilton are the Sole Distributors of all Copperweld Products including High Voltage Cable and Fine Wire.

CHILTON ELECTRIC PRODUCTS LIMITED
HUNGERFORD BERKS. *Telephone: Hungerford 237/8*
London Office:
19 Old Queen Street, S.W.1. Tel: TRAfalgar 2239

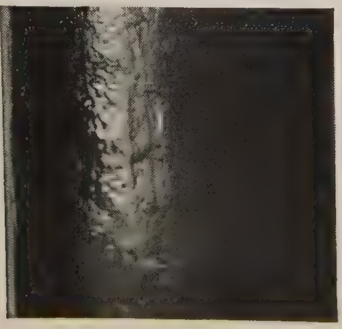
AP 88



AEI CORRUGATED ALUMINIUM-SHEATHED CABLE FOR B.R.

For the renewal of high voltage cables on British Railways' main London-Brighton-Worthing Line and in the Chislehurst-Sevenoaks area, A.E.I. are supplying, supervising the installation of and jointing 40 route miles of 0.15 sq. in. and 0.30 sq. in. 33kV 3-core oil-filled cables having circular aluminium conductors, corrugated aluminium sheath and anti-corrosion serving, together with 18 miles of plastic pilot/supervisory cable.

Illustration on right shows A.E.I. high voltage, oil-filled, corrugated aluminium-sheathed cable and pilot/supervisory cable (right) being laid during a night possession from a cable train near Shoreham, under the supervision of A.E.I. Construction (Cables and Lines) Division who also carried out the jointing.



AEI CABLE DIVISION

Associated Electrical Industries Limited

SUPER TENSION CABLE SALES DEPARTMENT

51-53 Hatton Garden · London EC1 · Telephone: CHAncery 6822

another NEW instrument from Salford, the

minitest

POCKET-SIZED MULTIRANGE TEST SET

A new compact instrument suitable for the measurement of D.C. voltages and currents, A.C. voltages and ohms. Its high sensitivity renders it suitable for testing and fault location in all types of electrical and electronic circuits. It is well built to ensure long and satisfactory service. The instrument is economically priced and supplied with test leads with plug connections at one end. (Leather carrying case available as an extra).

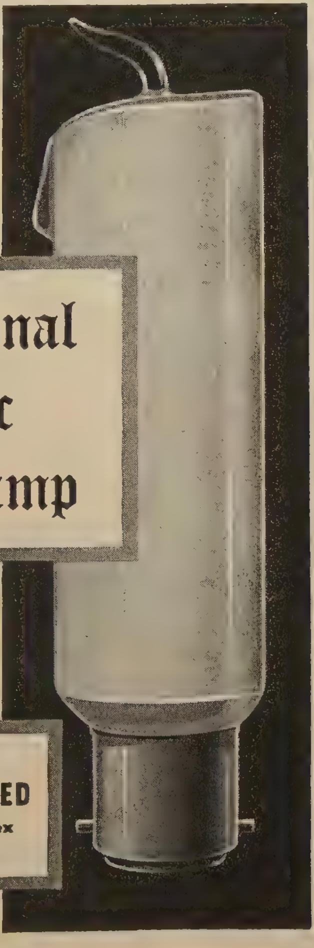
RANGES:	A.C. Volts.	2.5,	10,	25,	100,	250,	1000.
	D.C. Volts.	2.5,	10,	25,	100,	250,	1000.
	D.C. Amps.	50 μA,	1mA,	10mA,	100mA,	1A.	
	Ohms.	2000	200,000	20 MΩ			

ACCURACY:	D.C. Volts & Amps.	±2%	of full scale deflection
	A.C. Volts	±3%	of full scale deflection
		±5%	at centre scale.

neat and compact . . . with large instrument performance

SALFORD ELECTRICAL INSTRUMENTS LIMITED
Peel Works · Silk Street · Salford 3 · Lancs · Tel: Blackfriars 6688
London Sales Office; Magnet House, Kingsway, W.C.2. Tel: Temple Bar 4668
A Subsidiary of THE GENERAL ELECTRIC CO. LTD. OF ENGLAND

SEI

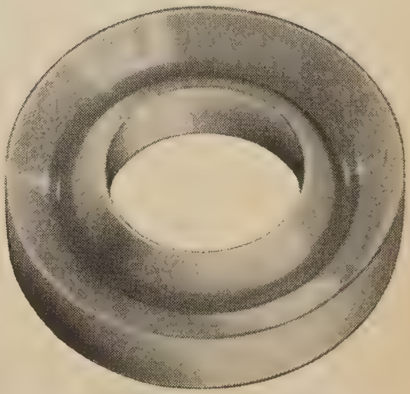


The Original Artistic Candle Lamp

In addition to a complete range of G.L.S. and modern contemporary lamps we also supply in 25W. and 40W. White or champagne colour glazed, red or green.* Standard Caps B.C. and S.B.C.
*Colour Sprayed.

All enquiries to:
ISMAY LAMPS LIMITED
Roden Street Works, Ilford, Essex
Telephone: ILFORD 1153

Save time and money on replacement and maintenance costs – fit



'DUBO'

British Patent Number 728196

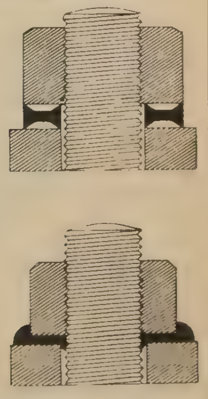
RETAINING RINGS to your nuts

Many users have already proved the great advantages of DUBO'S 4-way grip.

The cold flow action of DUBO nylon rings locks nuts securely. DUBO rings have excellent electrical properties, control electrolytic action, are unaffected by most chemicals. Fitted as easily as plain washers, DUBO rings are inexpensive initially, can be used over and over.

Write for DUBO literature.

Obtainable from Sole Concessionaires for the United Kingdom, Eire, the Commonwealth.



FAN DISC LTD. Telephone: CENtral 7617/8
109/111 Northwood Street, St. Pauls, Birmingham 3.

Trust a Maclaren!

Yes! trust a MACLAREN to be foremost! Seriously speaking, manufacturers do. That's why 95% of all the leading manufacturers of Immersion Heaters and Thermal Storage Water Heaters install dependable, long-lasting MACLAREN MB Thermostats. When it's new, or when it's time to renew, specify the thermostat you can trust—it's a MACLAREN!

"MACLAREN"

ELECTRIC THERMOSTATS

ROBERT MACLAREN & CO. LTD., EGLINTON WORKS, KILBIRNIE STREET, GLASGOW, C.5

London Office: *75 George Street, Portman Square, W.1.* **Manchester Office:** *120/126 Portland Street, Manchester 1.* **Midlands Office:** *61 Bridge Street, Walsall*

The use of epoxy resin castings offers the designer of electrical equipment many alternatives which often permit substantial improvements on earlier design and manufacture.

Excellent results have been obtained using this material for both large and small components for high and low voltage applications, from encapsulated small radio transformers to heavy current reactor coils. Castings are now being produced weighing from as little as a fraction of an ounce up to 4 cwts.

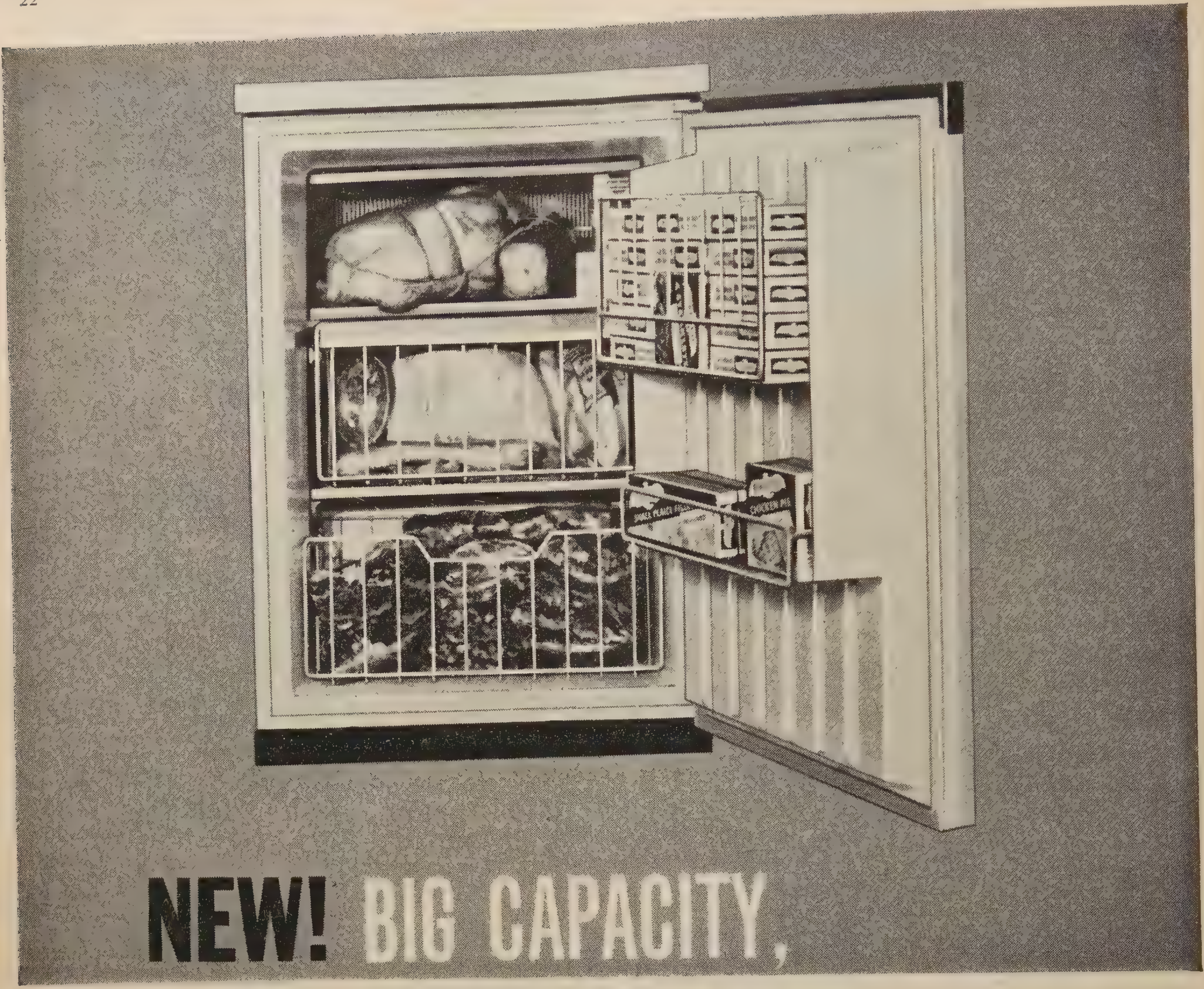
A specialist team of insulation and chemical engineers is available for consultation.

Send for Publication RC/101 describing the materials used, the process and the facilities available, to:

RESIN DEPARTMENT, KIDSGROVE, STOKE-ON-TRENT, STAFFS.

The English Electric Company Limited, English Electric House, Strand, London, W.C.2.

RC.1



LOW PRICE home freezer!

Kenwood meets the growing demand for real home deep-freezers . . . with the brilliantly designed Kenwood Freezer HF42A! This compact, work-height model has 4.2 cubic feet of genuine, sub-zero storage for keeping frozen packet foods and ice cream, garden produce, meat, fish and game indefinitely. The planned interior includes frozen food packet dispensers in the door . . . the superb cabinet has left or right hand flush-opening door, magnetic door seal, concealed door gasket, fits flush to the wall and rolls out for cleaning. All this . . . and its really down-to-earth price . . . make the Kenwood Freezer an outstandingly good seller in refrigeration!

Retail Price £60.14.10
+£11.14.2 P.T.
Optional working surface £3.3.0

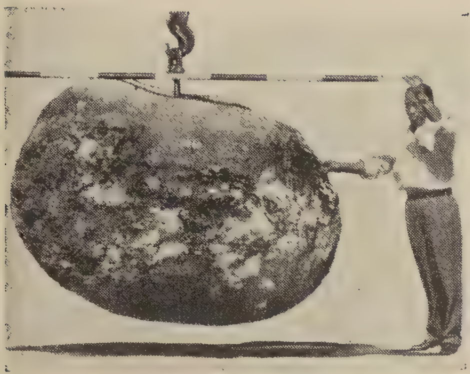
Every woman wants a **Kenwood** kitchen!

For full information and details of our generous co-operative advertising terms write to:
DEPT ER40 KENWOOD MANUFACTURING (WOKING) LTD · OLD WOKING · SURREY
One of the Kenwood Group

AMAZING WHAT RAWLPLUG FIXING DEVICES CAN DO!

Light job or heavy, solid material or cavity, Rawlplug Fixing Devices make every screw or bolt fixing easy and straightforward—even the 'impossible' ones! Just look at these examples.

BOLT FIXING . . .



Here's strength again! In Hong Kong, normal tackle failed to lift 5-ton boulders from a 20 ft. deep pit. Solved by drilling to take a 'K' size Rawlbolt with 1″ diameter eyebolt. Nothing approaches Rawlbolts for strength, ease and speed—no cold chiselling, no grouting in, no waiting for cement to harden.

CAVITY FIXINGS . . .

Can you imagine a more difficult cavity material than an eggshell? Yet here it is, screw-fixed with a Rawlnut! Use the appropriate Rawlplug Fixing Device—there are 24 different types—and you'll have no trouble with thin or hollow materials. And you'll save a lot of time!

SCREW FIXINGS

Here are ten men held by a single Rawlplug and screw in stone. *That's* the kind of strength you want, isn't it? Neat, safe, strong and completely reliable, indoors or out, in any climate. And Rawlplugs get the job done in a fraction of the time taken by any other method of fixing.

RAWLPLUG WALL PLUGS

Write now for full details of time-saving Rawlplug Fixing Devices, and of the many high-speed hole-boring tools, hand or power, that save you even more time.

Fixing Devices for speed and strength

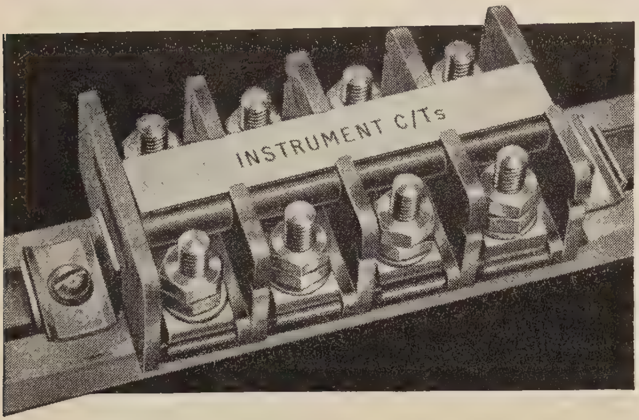
Made by the world's largest manufacturers of fixing devices

THE RAWLPLUG CO LTD · CROMWELL ROAD · LONDON SW7

8724

MILLIONS ARE USED EVERY WEEK THROUGHOUT INDUSTRY

BETA TERMINAL BLOCKS IN MOULDED NYLON



- Designed for simple and economical grouping of any number of ways.
- Extra ways can be added without dismantling or further drilling.
- Only two fixing screws required up to 12 ways.
- Transparent covers and name strips available.
- Carrying capacity 20 amperes.
- Tested to 4000 V. between terminals and to earth.
- Available with 0 B.A. and 2 B.A. studs.
- Moulded in NYLON, highly resistant to tracking and virtually unbreakable.
- Approved by C.E.G.B.

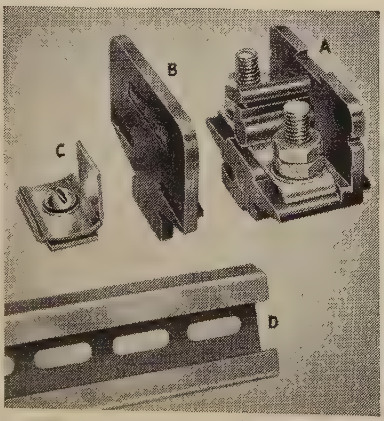
BASIC UNITS

A Body in moulded Nylon with brass connecting link with either 2 B.A. or O B.A. studs.

B Moulded Nylon barrier. Required only at one end of group.

C Cadmium plated steel end clamp, one required at each end of group.

D Cadmium plated slotted steel channel.



REF: 1106

CRITCHLEY BROS · LTD

BRIMSCOMBE · STROUD · GLOS · Tel: BRIMSCOMBE 2208 (3 lines)

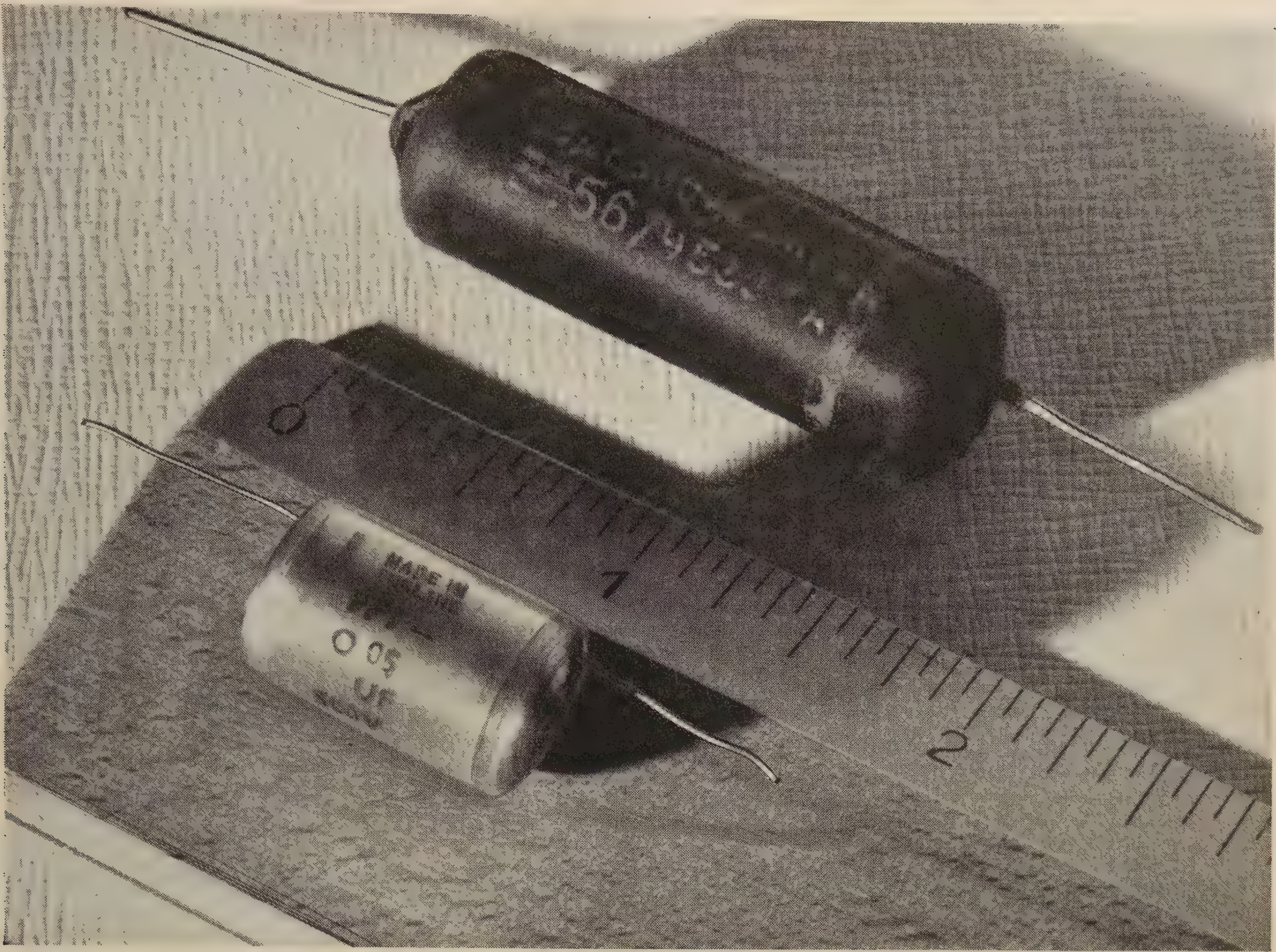
Don't get
your wires crossed!

—get in touch with us, we're really quite efficient.

We have been producing Copper Wire, Strand and Strip for a long time now and are well equipped to meet your needs.

R. H. SYMONDS LTD.

47 VICTORIA STREET, WESTMINSTER,
LONDON, S.W.1
TELEPHONE ABBEY 2771/5



Paper/foil and 'Melinex'/foil capacitors showing the considerable saving in volume when 'Melinex' is used.

'Melinex' makes electrical components smaller, more efficient

'Melinex', the tough, transparent polyester film made by I.C.I., already has a great reputation in the Electrical Industry. To meet the ever increasing demand for 'Melinex', I.C.I. are operating a new 2,000 tons-a-year plant at Dumfries.

One big reason for the popularity of 'Melinex' with Electrical Engineers is its high mechanical and dielectric strength. This enables it to be used in really thin gauges—as thin as 0.00025 inch.

Other important 'Melinex' properties are low water absorption, good chemical resistance and resistance to high and low temperatures. You will find it used in:— Capacitors; Slot Liners; Cables; Loudspeaker Diaphragms; and as interlayer insulation in Transformers, Relays, Solenoids and Chokes.

If you would like more information about 'Melinex' and the Technical Service available, your nearest I.C.I. Sales Office will be glad to help you.

'Melinex'

'Melinex' is the registered trade mark for the polyethylene terephthalate film manufactured by I.C.I.

ICI

PME8

IMPERIAL CHEMICAL INDUSTRIES LIMITED · LONDON · S.W.1

for
MICANITE COIL SLOT
INSULATION

Consult
EAST LONDON MICA WORKS

Phone: COPpermill 2248/9
Telegrams: Elmicmer, Easphone, London

RINGWOOD RD., WALTHAMSTOW, LONDON, E.17
ESTD. 1912

TEST LAMP

500 VOLTS A.C. D.C.
PRICES:–

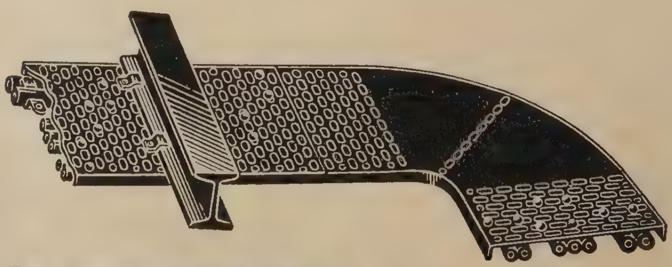
M.T.L.1 (Shown)	31/6
M.T.L.3 (Removable Prongs)	36/9

"Towards safety in Industry"

JOHN DRUMMOND (Engineers) LTD.
BELLCRAG WORKS - DALSHOLM ROAD - MARYHILL - GLASGOW
Tel: MARyhill 3315/6

PERFORATED METALS

★ FOR ALL ELECTRICAL REQUIREMENTS
★ PERFORATED LEAD FOR BATTERIES
★ CABLE TRAYS AND BENDS FOR ALL ELECTRICAL WIRING



BARNS

W. BARNS & SON (HOLLOWAY) LIMITED
Globe Works, Queensland Road, Holloway, N.7
Telephone: NORth 3347/8
Telegrams: Perforation, Holway, London

SULZER

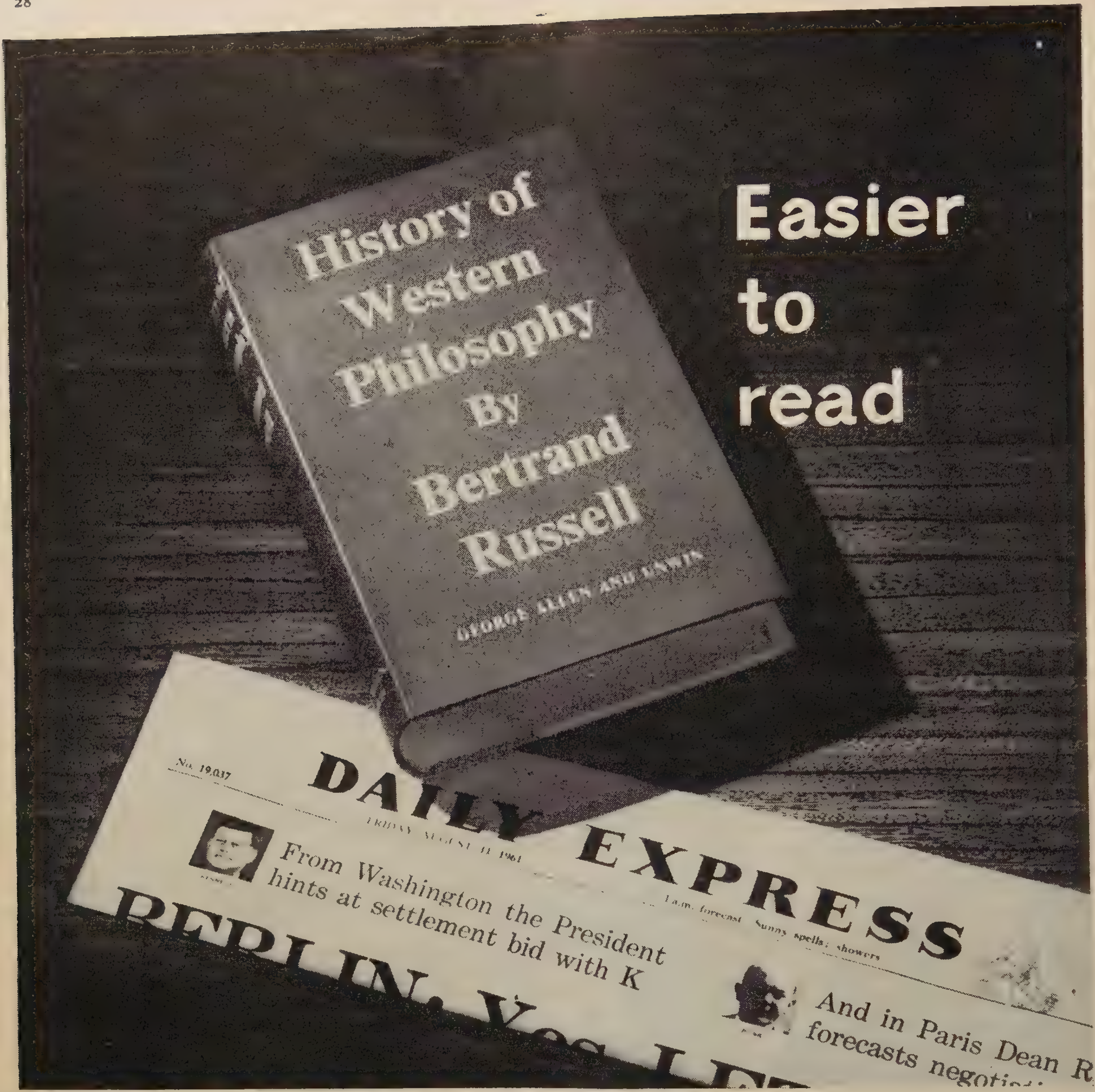
Pumps for Power Station Duties

1400 H.P./2950 r.p.m.
Boiler Feed Pumps
installed in the
Ince Power Station
of the C.E.G.B.

By kind permission of the C.E.G.B.

Vertical Spindle
Mixed Flow
Screw Pumps
for Cooling
Water Duty

SULZER BROS. (LONDON) LTD.
(Incorporating Hathorn Davey & Co. Ltd.)
31 Bedford Square, London, W.C.1.


Easier to read
History of Western Philosophy By Bertrand Russell
George Allen and Unwin
No. 19,037
DAILY EXPRESS
Friday August 11 1961
1 a.m. forecast Sunny spells; showers
From Washington the President hints at settlement bid with K
BERLIN: Yes LET
And in Paris Dean R forecasts negoti

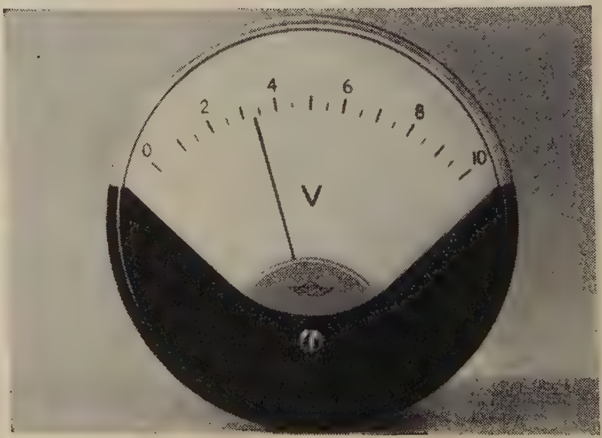
No matter which kind of reading you yourself find more enjoyable, there couldn't be anything *easier* to read than the Pullin range of Clear View instruments. Every Clear View instrument is a perfect example of clarity and precision. Designed to be seen *and* believed.

one of the range

The Series 38 CY (3.8″ scale) *Approximate viewing distance 4 ft. 6ins. with moving iron or internal magnet moving coil movements.*

See for yourself, write for details of the Clear View range.

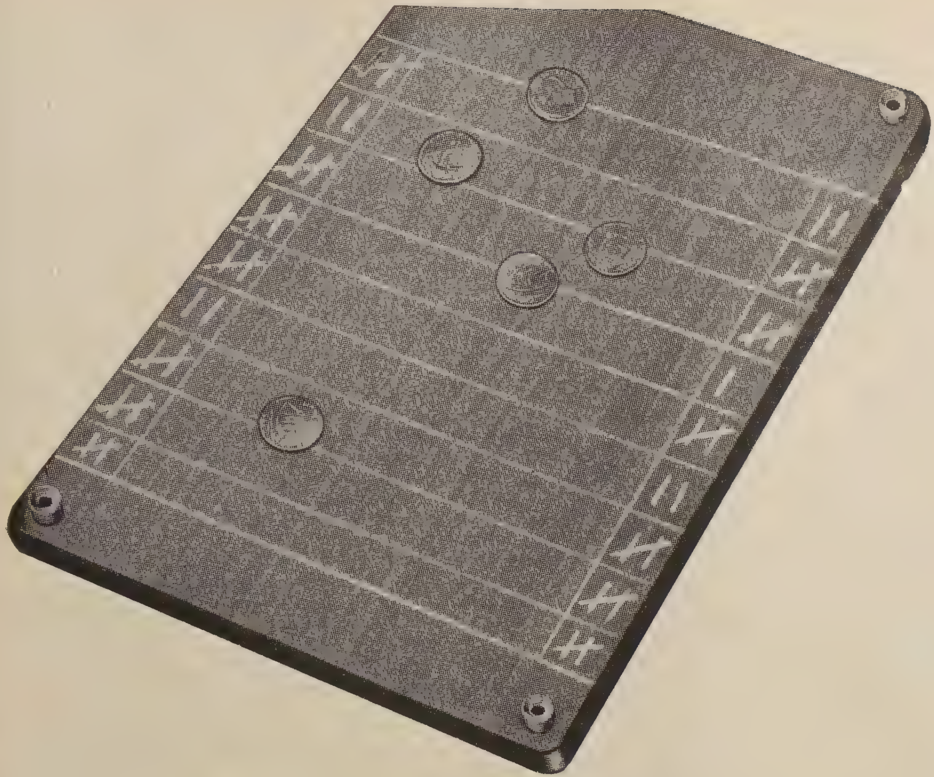
PULLIN FOR PRECISION



MEASURING INSTRUMENTS (PULLIN) LTD.

Head Office: *Electrin Works, Winchester Street, London, W.3. Telephone: ACOrn 4651 and 8801*

London Showrooms: Electrin House, 93-97 New Cavendish Street, London, W.1. Telephone: LAN 4551-6



Wootton meter boards win every time!

Obviously, when they're Wootton-made, and Wootton-tested. Made from the best plywood Wootton could lay hands on. Tested for reliability . . . toughness . . . durability. Wootton meter boards stand up to anything. No contraction or expansion warping with Wootton! Oh, and there's more to Wootton than just meter boards. They make wood blocks too, and instrument cases, and they're brilliant at sunk switch boxes.

WOOTTON-the meter board people

WOOTTON & CO. LTD
ALMA WORKS · PONDERS END · MIDDX
Telephone: HOWard 1858

FOR YEARS OF RELIABLE SERVICE CHOOSE

RELAYS & CONTACTORS

We specialise in the manufacture of vital components for use in the automatic electrical control gear field.

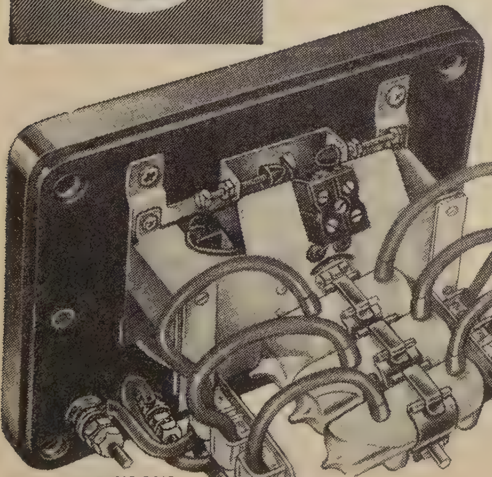
The relays and contactors illustrated are typical of the wide range of units manufactured for control purposes.

Relays of the tilting mercury switch type are manufactured in sizes up to 200 amp. triple pole and in encapsulated pattern up to 30 amp. triple pole.

Metallic contact relays are available in plug-in version with contact ratings of 3 amp. 240v. A.C. double pole change-over arrangement.

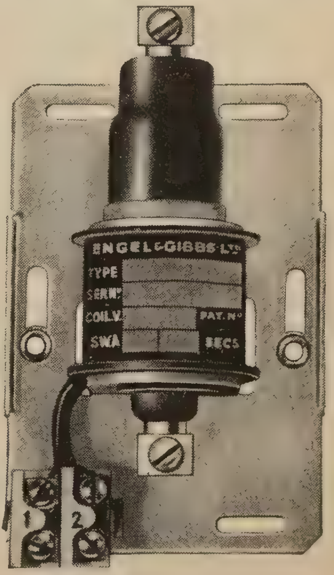
In addition to relays and contactors we manufacture a series of Temperature Sensitive Switches and are always pleased to quote for control panels of all types.

PLEASE WRITE FOR FULL DETAILS



MARK 2 30A TRIPLE POLE CONTACTOR

PLUG-IN RELAY



METAL MERCURY SWITCH ENCAPSULATED RELAY
NEW PRODUCT

ENGEL & GIBBS LIMITED

ELSTREE WAY BOREHAM WOOD HERTS. Phone: ELSTREE 2291/4

Precision

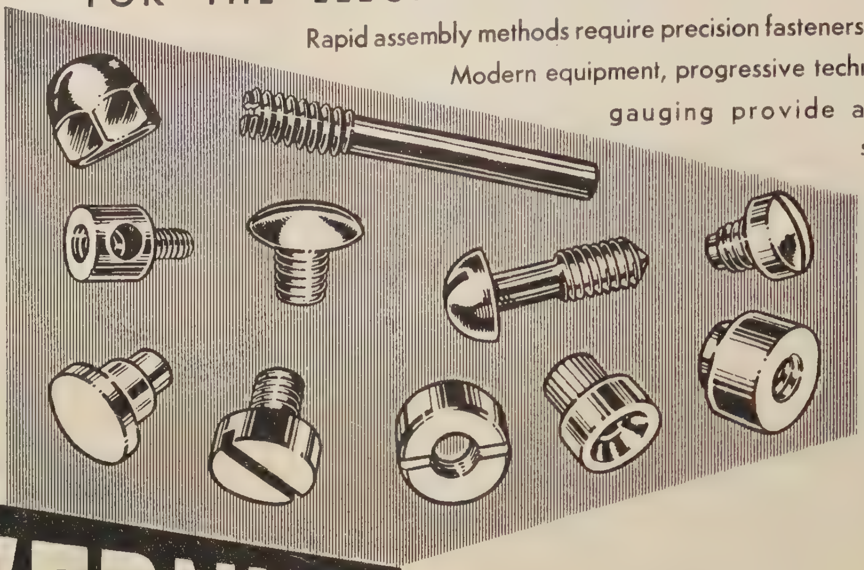
TURNED FASTENERS

FOR THE ELECTRICAL AND ALLIED TRADES

ALL AUTOMATIC AND CAPSTAN TURNED PRODUCTS

Rapid assembly methods require precision fasteners and components. Modern equipment, progressive technique, and quality gauging provide an unsurpassed specialist service.

STOCKS of standard turned screws available for immediate use



VERNIER

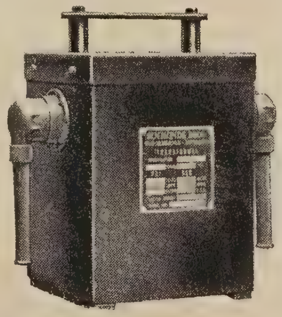
MANUFACTURING CO. LTD.
15-19 Garman Road, London, N.17
Telephone: Tottenham 5077

VOLTAGE DROPPING TRANSFORMERS

For Electric Tools on 110 volts

Full range of fixed and portable types in all capacities, or made to specification. *List free.*

SIMMONDS BROS.
STOURBRIDGE



For Commutator
Maintenance Equipment
Consult the experts . . .

MARTINDALE

ELECTRIC COMPANY LIMITED

4 WESTMORLAND ROAD, LONDON, N.W.9

. . . for all electrical installations

F. H. Wheeler
& Co. Ltd.

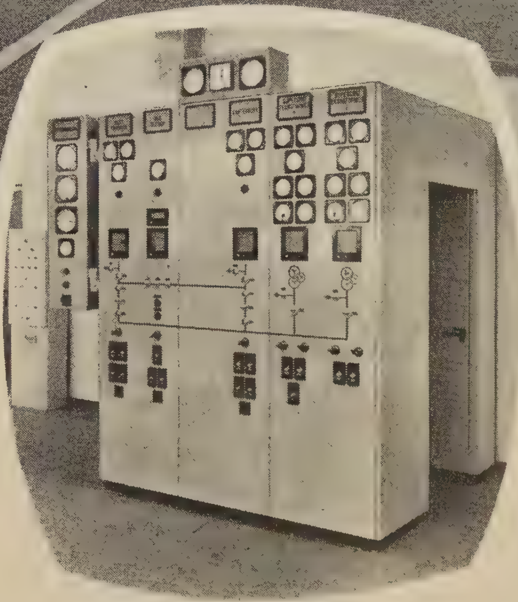
London, Birmingham, Bournemouth, Bristol, Cardiff, Manchester, Newcastle, Sheffield, Southampton

Member of the K. G. (HOLDINGS) LTD. Group of Companies

Lydd Converter Station

Photographs by courtesy of C.E.G.B., South Thames Division.

Part of the 275-kV sub-station showing the Bus-Section and Canterbury Feeder circuit-breakers.



The control board for the 275-kV switchgear.

Equipment supplied by Reyrolle for the English end of this important cross-channel d.c. cable-link with France includes:

275-kV 7,500-MVA air-blast switchgear

11-kV 250-MVA oil-break switchgear

380-volt air-break distribution gear for the auxiliaries associated with the converter valves

Control boards for the remote control of the 275-kV, 11-kV, and 380-volt switchgear

Relay boards for the protection of the 275-kV and 33-kV circuits

Reyrolle

A. REYROLLE & COMPANY LIMITED - HEBBURN - COUNTY DURHAM - ENGLAND

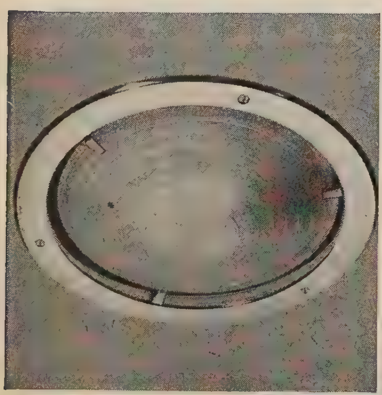
ASK

LUMITRON

EVERY TIME
YOU NEED . . .
WELL DESIGNED

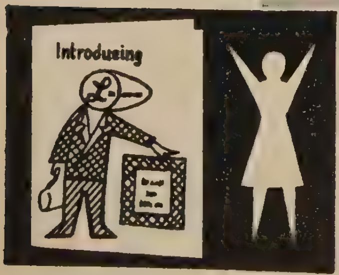
LOW COST SPOT

LIGHT FITTINGS



535 BC/100/150W
Recessed ceiling fitting in aluminium mirror finish with lens.
55/-
(Plus 11/- P.T.)

508a SM/BC/100W
Stoved enamel finish —4 colours—ivory, black, canary yellow and signal red.
32/-



Send for
latest
SPOT
CATALOGUE

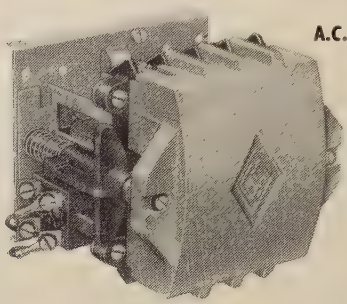
LUMITRON LTD
Manufacturers of contemporary lighting fittings

Showrooms and Trade Counter
180 SHAFTESBURY AVENUE, LONDON, W.C.2
COVent Garden 0126/7

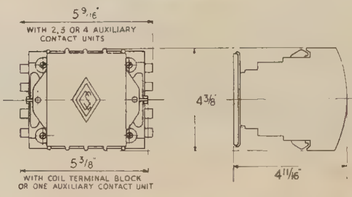
Works and Trade Counter
HYTHE RD., SCRUBBS LANE
N W. 10. LAD: 2262/3

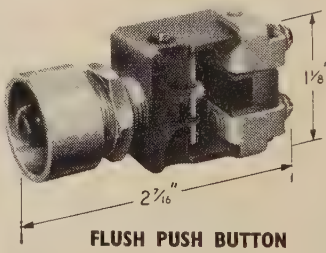
Save Space!

SPECIFY
MINIATURISED
ELECTRICAL
ACCESSORIES

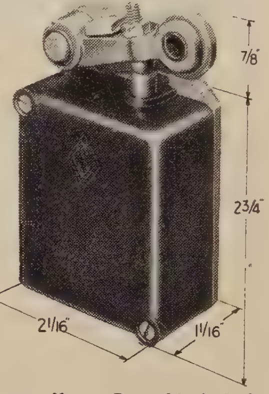


A.C. CONTACTOR REFERENCE 26
12½ h.p. 415 v. 50 cycles. 3 phase.
Tested to prove compliance with BSS775/1956, and is rated at 25 amperes Category A1, Class II and 12½ HP (20 amperes) Category A4, Class II at 380/550 volts. Category A4, Class III and IV ratings available on application.

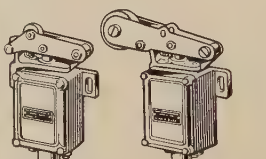

5 9/16"
WITH 2, 3 OR 4 AUXILIARY CONTACT UNITS
4 3/8"
5 3/8"
WITH COIL TERMINAL BLOCK OR ONE AUXILIARY CONTACT UNIT
4 11/16"

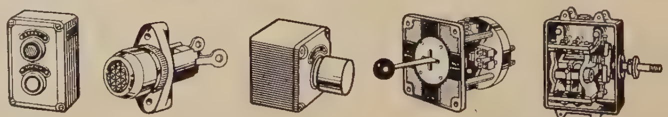


FLUSH PUSH BUTTON



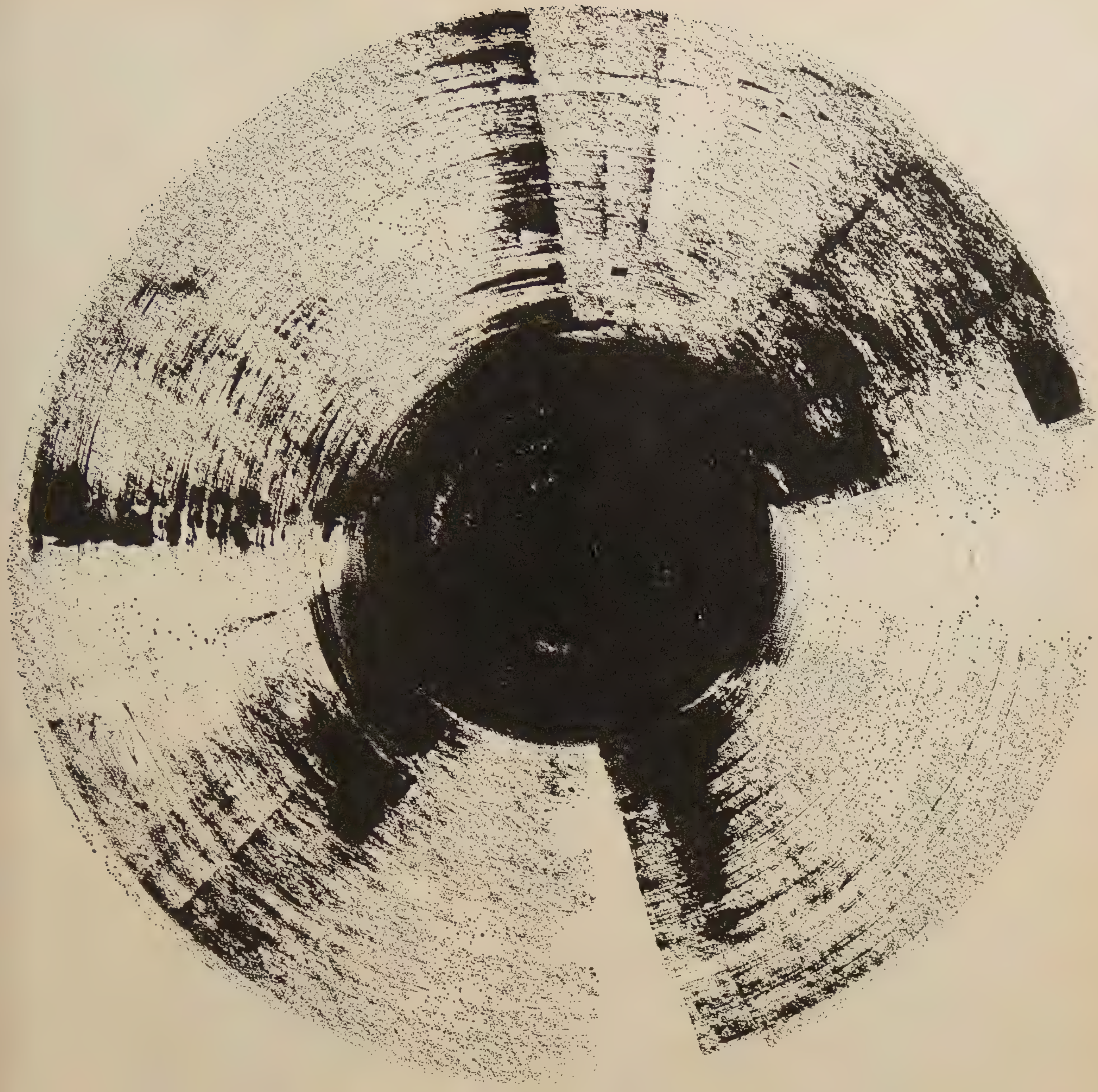
Miniature Heavy Duty Limit Switch
Life tested to 19 million Operations.
Change-over contact
Quick make and break
Rating:
2 amps 250 v } A.C. Inductive
1 amp 500 v





★ Send for a copy of Publication No. 83 which illustrates a selection from our comprehensive range of accessories for control gear.

CONTACTOR SWITCHGEAR LTD.
Incorporating
Contactor Switchgear (Electronics) Limited
MOORFIELD RD., WOLVERHAMPTON, ENGLAND
Telephone: Wolverhampton 25911/7
Telegrams: TACTORGEAR, Wolverhampton



FANS

Axial flow or centrifugal. In every case the capacity quoted is fully guaranteed. All usual requirements are covered by the standard Airscrew range with their guaranteed performance figures. Particular applications can usually be met by modified designs, made up from stock components. Where highly specialised units are called for, the great experience of Airscrew in applied aerodynamics quickly solves the problems. In every case, the result is efficiency at a competitive price.

AIRSCREW FOR FANS

THE AIRSCREW COMPANY AND JICWOOD LIMITED · WEYBRIDGE · SURREY · *WEYBRIDGE 2242* AP 79

The choice
is often difficult

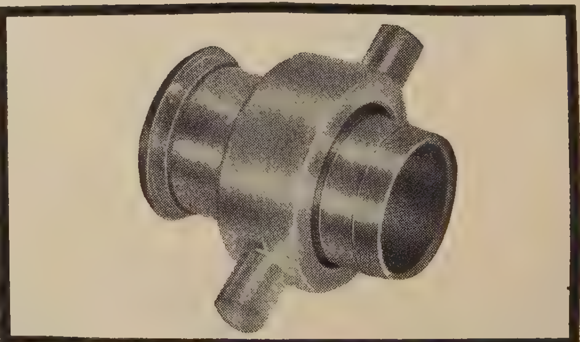
May we pick the winner for you . . .

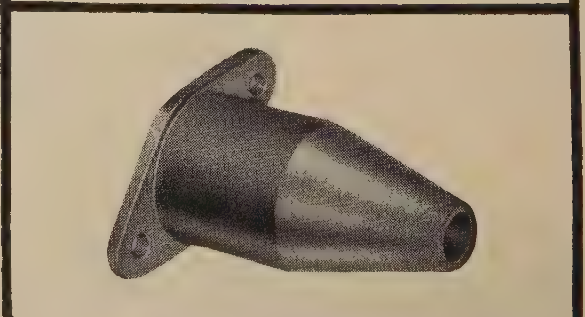
When choosing between Die Castings or Hot Pressings you can count on us for sound, unbiased advice. We make both HOT PRESSINGS in *Brass, Bronze, Copper or Aluminium,* and GRAVITY DIE CASTINGS in *Brass, Bronze or Aluminium.* The unique experience of our organisation . . . two separate yet inter-related operations under one roof . . . will ensure that your choice is correct.

For a constant or phased supply of DIMENSIONALLY ACCURATE PARTS in *Brass, Bronze, Copper or Aluminium*—see us first! Our Technical Representatives are always at your service.

BRASS PRESSINGS (LONDON) LTD.
THE NON-FERROUS DIE CASTING CO. LTD.
NON-FERDICA WORKS, NORTH CIRCULAR ROAD, LONDON, N.W.2
Tel.: GLAdstone 6377

1732





wiring
timber
buildings

BICC mineral insulated copper sheathed cable is ideal for the wiring of timber buildings — it is fireproof, waterproof, mechanically tough, non-ageing and easily installed.
Over 2,500 yards of BICC M.I. cable has been installed in the recently completed timber-built Wave Basin enclosure at the Hydraulics Research Station at Wallingford, Berkshire.

BICC M.I. CABLES

BRITISH INSULATED CALLENDER'S CABLES LIMITED
21 BLOOMSBURY STREET, LONDON, W.C.1

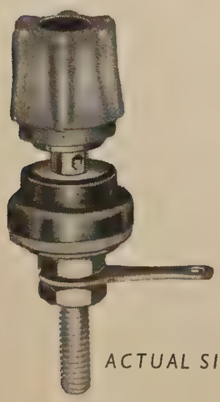
Architect:
Mr. O. P. Carver, A.R.I.B.A.,
Senior Architect
at the Ministry of Works.

Electrical Contractor:
R. McEwan & Co. (Woking) L
Woking, Surrey.

Modelling a harbour installati at the Wave Basin to study the effects of simulated tidal conditions.

"Belling-Lee"
CONTINENTAL
TERMINALS*

Carrying on the tradition



ACTUAL SIZE

These latest terminals from "Belling-Lee" carry on a fine tradition which began nearly 40 years ago when the Company first entered the component market —with a range of terminals, which achieved an immediate success. Contemporary in style and materials, and economical in price, they have a top socket for continental wander plugs (4 mm.)—as well as our "OZ" pattern, of course—and have unified threads (No. 8, 32 U.N.C., Class 2A). There is a cross-hole in the clamping gap, which is free from threads, and the head is moulded in polypropylene in a range of six standard colours, black, blue, green, red, white and yellow. Current rating 15A; proof voltage 2·5—3 kv, according to type.

Most "Belling-Lee" products are covered by patents or registered designs or applications

*TERMINALS · PLUGS AND SOCKETS · GLASS SEALS
CIRCUIT PROTECTION DEVICES
INTERFERENCE FILTERS · RECEIVING AERIALS
"PRESTINCERT" COMPONENTS

BELLING & LEE LTD
GREAT CAMBRIDGE ROAD, ENFIELD, MIDDX., ENGLAND
Telephone: Enfield 5393 · Telegrams: Radiobel, Enfield

HIGGS

present their

MAXI MOTOR

range

TOTALLY ENCLOSED FAN COOLED MOTORS AT DRIP PROOF PRICES

TO B.S.2690 BRITISH STANDARD DIMENSIONS 2.3.5.7½ H.P. 4 POLE

MAXIMUM ▶ *Quality*
Efficiency
Dependability

MAXI MOTOR EXCHANGE/REPAIR SERVICE

These quality motors are designed to give many years of good service. In the unlikely event of breakdown, use our Maximotor low cost immediate replacement Service.

Our Service keeps you going!

HIGGS MOTORS LTD - BIRMINGHAM 6 - BIRchfields 4545

DO YOU KNOW . . .

PRODUCTION It takes at least thirty people—thirty pairs of skilled hands—to make one DORMER Drill. Every operation is performed by experienced operators with the most up-to-date machinery. Careful heat-treatment and inspection are equally essential in maintaining the consistently high standard of DORMER Tools.

At least one in every ten people employed in the manufacture of DORMER Drills is an Inspector. Throughout production and before each DORMER Tool leaves the works, every feature is checked in minute detail.

INSPECTION

PERFORMANCE

With correct use, a DORMER Drill of 1″ diameter, in its lifetime on general purpose work, will remove 2,800 times its own weight in material (over 1¾ tons), and drill a total length of hole five hundred yards long!

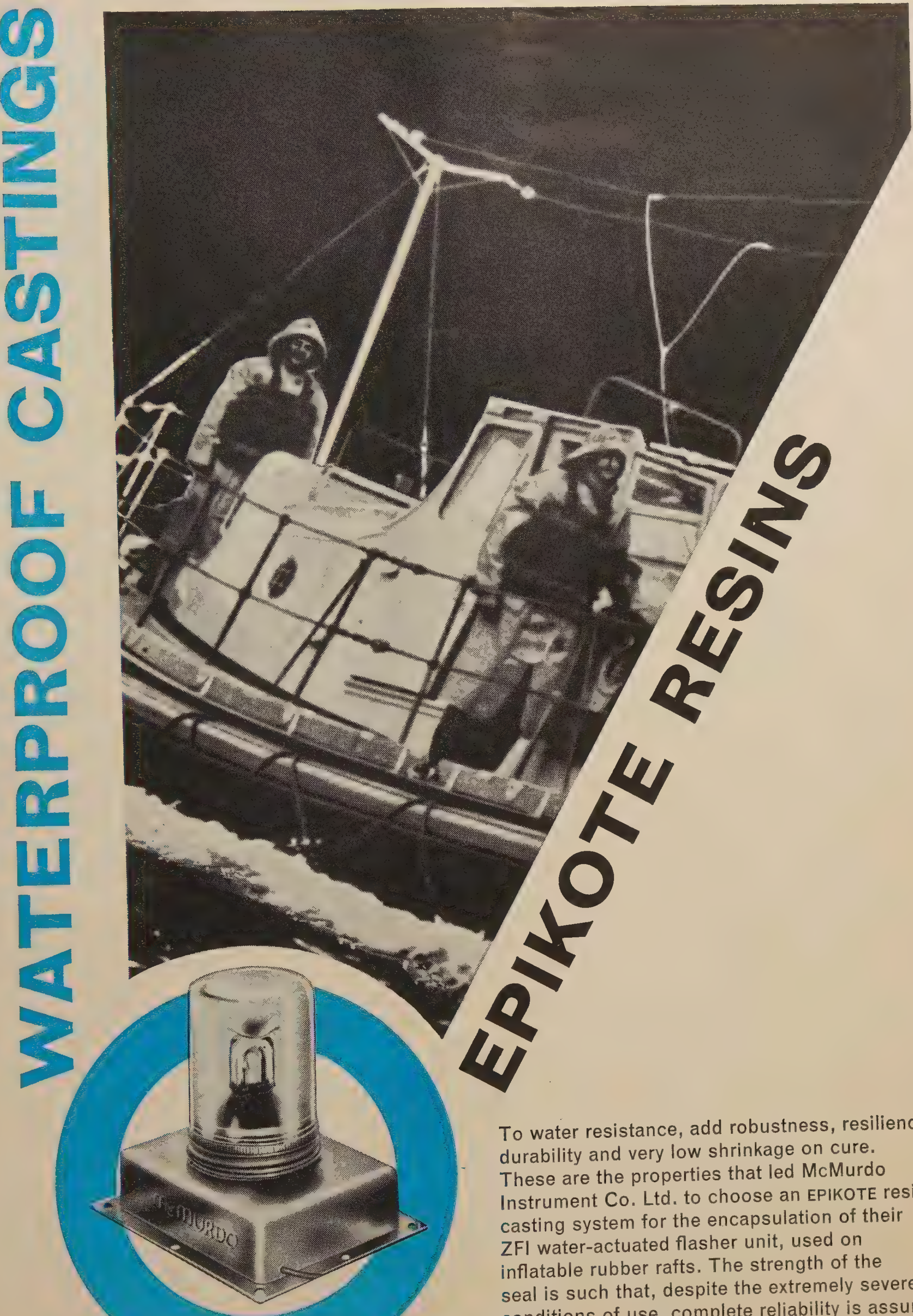
DORMER

TWIST DRILLS

THE FINEST BY ANY STANDARD

THE SHEFFIELD TWIST DRILL AND STEEL COMPANY LIMITED
SHEFFIELD
ENGLAND

DORMER TOOLS ARE OBTAINABLE FROM YOUR USUAL ENGINEERS' MERCHANTS



To water resistance, add robustness, resilience, durability and very low shrinkage on cure. These are the properties that led McMurdo Instrument Co. Ltd. to choose an EPIKOTE resin casting system for the encapsulation of their ZFI water-actuated flasher unit, used on inflatable rubber rafts. The strength of the seal is such that, despite the extremely severe conditions of use, complete reliability is assured. Would this approach solve a problem for you? Ask for full details quoting No. EE.17.

SHELL CHEMICAL COMPANY LIMITED
Marlborough House, 15-17 Gt. Marlborough Street, London, W.1
SHELL and EPIKOTE are registered trade marks.

Shell Chemicals SHELL

Star..
Regent..
Monarch..
Simplex

THE SIMPLEX RANGE COVERS EVERY *M. V.* SWITCHGEAR REQUIREMENT

Whether you judge by sheer value for money, by design or by unsurpassed technical reliability, Simplex make switchgear that leads the industry. The challenging up-to-date competitive Star range is cleanly styled in pressed steel cases; the conventional Regent in cast-iron and composite metals; and the heavy duty Monarch is clad in all cast cases. All three ranges comply with latest BS specifications, are complementary to the others, and can be built up as switchboards to meet any requirement. Technical data and the co-operation of a friendly advisory service is always available.

Simplex

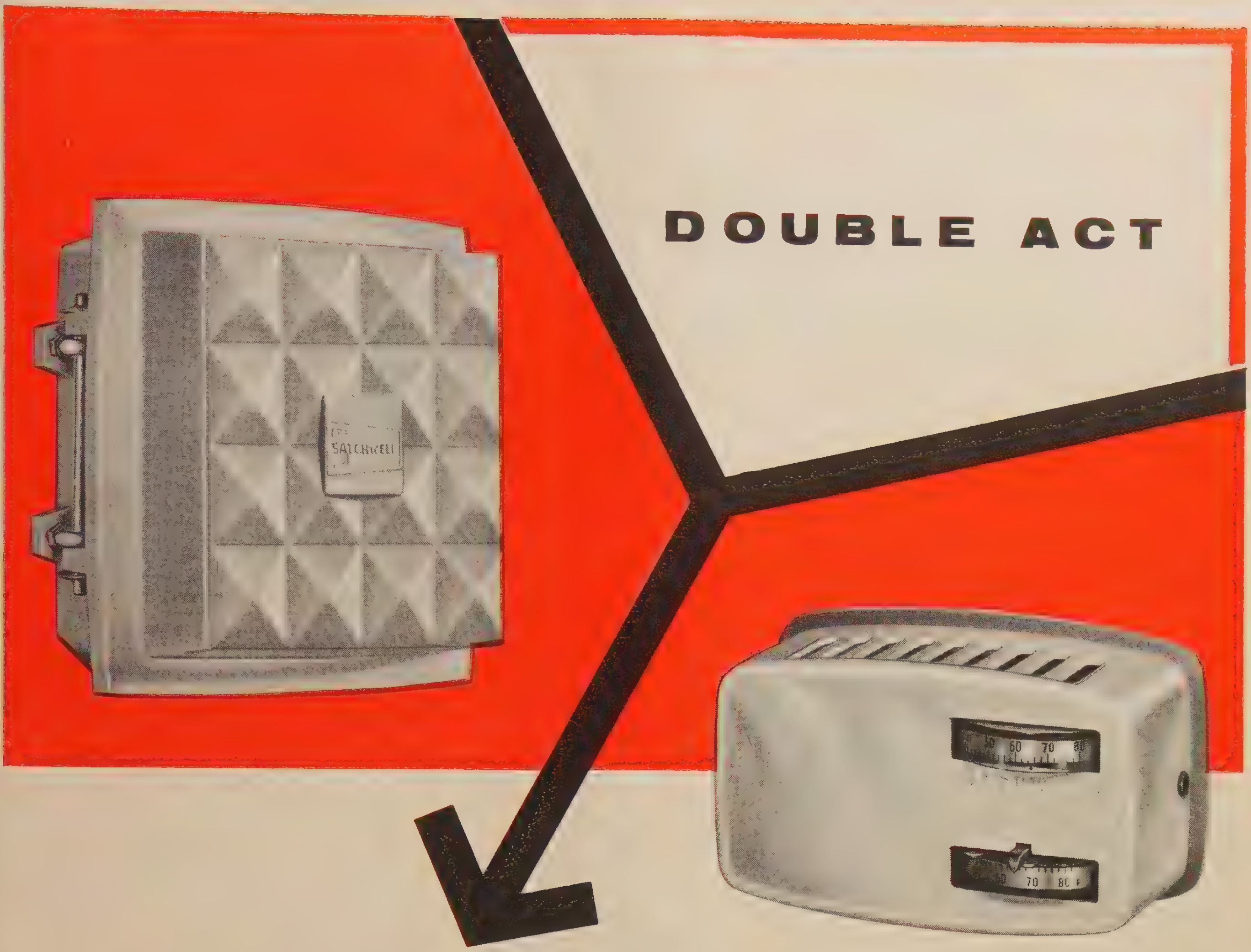
ELECTRICAL DIVISION

SIMPLEX ELECTRIC COMPANY LIMITED · CREDA WORKS · BLYTHE BRIDGE · STOKE-ON-TRENT · STAFFS
Branches throughout Great Britain and Agents throughout the World

Simplex Star. Economically priced, front operated switchfuses in 15, 30, 60 amp. 500 volt. Busbar chambers 200, 400, 600 and 800 amp 600 volt. Distribution fuseboards 15, 30, 60 amp. 500 volt.

Simplex Regent. Robust, stylish switches, switchfuses, changeover switches 15, 30, 60 and 100 amp. 500/600 volt. Busbar chambers 350, 550, 800 amp. 600 volt. Distribution fuseboards 15, 30 amp. 500 volt.

Simplex Monarch. Heavy duty fuse switches, suitable for all lighting, heating and power loads without de-rating. 150, 300 amp. 500 volt



SINGLE PURPOSE

After extensive research, backed by exhaustive practical tests, it has been proved that the most effective method of control for underfloor electric heating systems is by measuring both inside and outside conditions at the same time.

The Satchwell Ratiomatic is an entirely new control system based on this assertion.

An outside detector governs the duration of the charge for the coming day. An inside detector measures the effectiveness of the previous night's charge and only increases the next charge if the inside temperature is lower than that desired. An infinitely variable charge—anything from 100% to zero—is provided by this system.

Please write to us for full details.

SATCHWELL

SATCHWELL RATIOMATIC

For the most effective control of

DOMESTIC OFF-PEAK

ELECTRIC FLOOR HEATING

THE RHEOSTATIC CO. LTD • SLOUGH • BUCKS

EA *A member of the Elliott-Automation Group*

WHEN LENGTHS OF DEEP SEA CABLE ARE HANDLED ABOARD H.M.T.S. MONARCH

Preformed

HOLDS THE LINE....

H.M.T.S. Monarch which has laid the deep sea telephone cable to Canada as part of a projected Commonwealth round - the - world link-up. Photograph by courtesy of H.M. Postmaster-General.

...because the unique Helical gripping of PREFORMED Dead Ends* gives low localised stress. It holds the extra high tensile steel core of this revolutionary type cable through *five slip surfaces* without damaging the polythene sheath. This is an outstanding example of the extreme holding power of PREFORMED Dead Ends. Easily and quickly applied—PREFORMED Dead Ends are the discerning engineers choice.

Other Preformed Products Include:
LINE GUARDS—*for conductor protection at insulators*
LINE SPLICES—*full tension joints*
PATCH RODS—*for repair of strands*
GUY GRIP *Dead Ends—the most economical way of making-off stays*
ARMOR GRIP SUSPENSION ASSEMBLY—*a revolutionary suspension clamp*
SPLICE SHUNTS—*for overheated joints*
BUNDLED CONDUCTOR SPACER UNITS—*the best twin conductor spacer*
*Patent Application Number 817535

BRITISH PLP

Send for Technical Brochure available in ENGLISH, FRENCH, GERMAN or SPANISH

PREFORMED LINE PRODUCTS
(GREAT BRITAIN) LIMITED

ANDOVER · HAMPSHIRE · ENGLAND · TELEPHONE · ANDOVER 4044/5
Other products mentioned are covered by patent and patent application Nos. 817055, 817534, 805333, 817643, 817644, 788908, 817535
Agents in Countries Throughout the World
Manufactured under licence from PREFORMED LINE PRODUCTS CO., CLEVELAND, OHIO, U.S.A.

H.P. 8699

They take it for granted

A new set? Their first set? Either way it is exciting and important to choose one to suit their pocket and their taste. They will consider screen sizes, controls, cabinet finish, portability, built-in radio and half a dozen other aspects of this scientific marvel which can introduce them to a fresh world of people, places and ideas.

What of the engineering skill and materials inside the magic box? Almost certainly they will be taken for granted. But the manufacturer of radio and television equipment is well aware that in the long run this is where reputations can be made, sustained or lost. When British Driver-Harris nickel alloys are incorporated, the manufacturer can safely rest assured that in this department his reputation is in safe hands.

GLASS SEALING ALLOYS for cathode ray tubes and for contact pins in moulded glass radio valve bases.
PURE NICKEL for cathode ray tube and radio valve components (cathodes, anodes, supports and lead wires.)

"Electrical Alloy Data" contains 84 pages of fundamental information concerning the use of electrical resistance alloys. Copies are available free of charge on request.

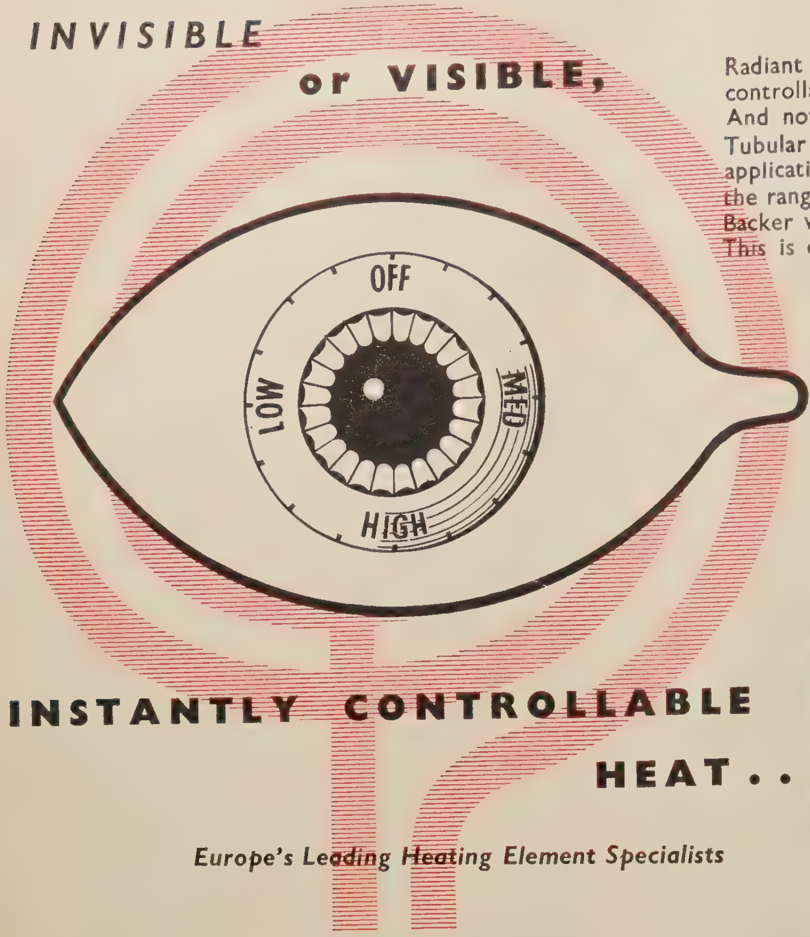
BRITISH DRIVER-HARRIS CO LTD

CHEADLE HEATH, STOCKPORT, CHESHIRE

NICHROME
REGD TRADE MARK

INVISIBLE

or VISIBLE,



Radiant heat for efficient cooking. Electric heat, controllable at the turn of a switch.
And not for cookers only. In industry at large, Backer Tubular Sheathed Heating Elements have hundreds of applications, with working temperatures covering the range 50°C to 800°C—"black" or red heat. At Backer we build to your specification.
This is our speciality and our single purpose.

TUBULAR SHEATHED
HEATING ELEMENTS
available in
'INCONEL' and 'INCOLOY'
18/8 STAINLESS STEEL
MILD STEEL
and 'BUNDYWELD'
'MONEL'
ALUMINIUM BRASS
and ALUMINIUM BRONZE
COPPER NICKEL

INSTANTLY CONTROLLABLE HEAT . .

Europe's Leading Heating Element Specialists

Backer

BACKER ELECTRIC COMPANY LIMITED
ROTHERHAM . YORKS
Telephone: Rotherham 78181 (8 lines). Telex: 54161

This saw cuts both WOOD & METAL

The 'Eclipse' General Purpose saw will cut both wood AND metal—*one* saw for all the odd jobs about the house, the farm, the garden, the building site and so on. If the "odd job" is the cutting of hard wood, soft wood, wood in which nails or bolts are embedded, hard rubber, plastics, fibreboard, the everyday range of pipes and bars made from mild steel, copper, brass, aluminium, lead and the like, here's the saw that will cut through the lot! The blade can be adjusted for sawing in almost any position.

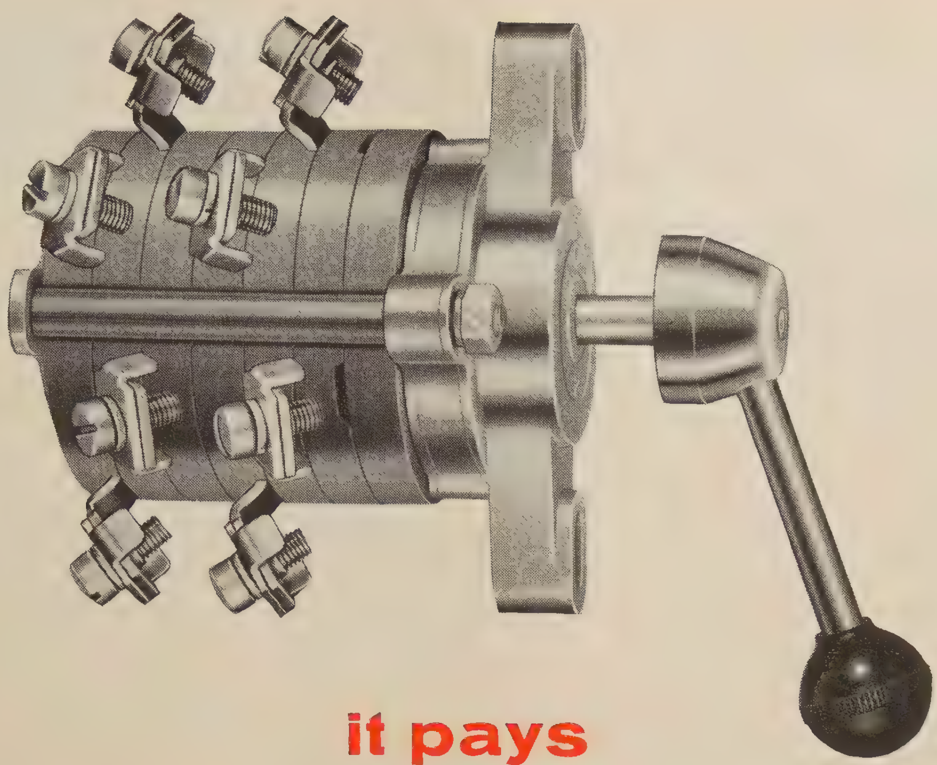
Eclipse

G.P. SAW

15/6d

'Eclipse' hacksaw blades and other tools are made by James Neill & Co. (Sheffield) Ltd., and are obtainable from all tool distributors

SSA 14

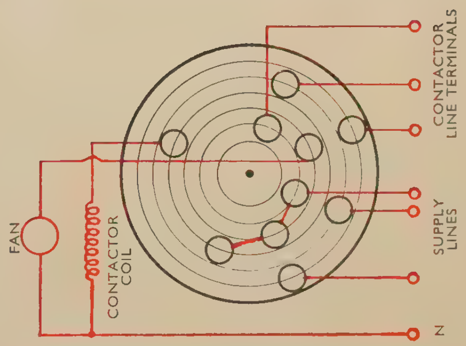


it pays
to switch
to

ARROW

multi-circuit
switches

Ratings 10 to 200 amps up to 600 volts AC or DC
Minimum panel space required
Of robust construction and approved design
Delivery is assured within a few days
Write or telephone TODAY for full information



Simultaneous switching of various circuits saves space.

ARROW Electric Switches Ltd

Brent Road
Southall
Middlesex
Telephone: Southall 2442

SEMI-CONDUCTOR RECTIFIERS are not likely to be the prey of Tigers, which are notoriously carniverous in their selection of victims. Nevertheless, these rectifiers do need protection from the more serious hazards of excessive currents and transient voltages. Complete protection can now be obtained from the range of EMP H.R.C. Fuse-Links and Surge Diverters.

FUSE LINKS

Specifically developed with melting time/current characteristics matching the rectifier survival characteristics, the fuse-links incorporate shaped elements designed to limit the maximum transient arc voltage to less than 1·5 times the peak of the rated value. The fuse-links are available for both *medium* and *high voltage* applications.

★ Type tested to meet the most onerous fault duties.
★ Ratings: M.V. from 10A to 800A up to 650V (P.I.V.)
H.V. from 10A to 300A up to 6kV (P.I.V.)
★ Fitted with indicating devices and/or striker pins.

SURGE DIVERTERS

Specifically developed for a.c. or d.c. semi-conductor rectifier applications, the Surge Diverters are designed such that rapid and consistent low value spark-over of gaps is ensured — even for times to spark-over measured in tenths of a microsecond.

★ Surge protection down to 500V.
★ Special traction duty range.
★ D.C. types incorporate magnetic arc-control.

EMP

EMP ELECTRIC LIMITED

GARMAN ROAD, LONDON, N.17
Tel: Tottenham 5591 (5 lines) Grams: " Arrester, London "

IT/EEI

CONTROLLING GLARE
BZ (British Zonal Classification)
PRISMATIC PLATES

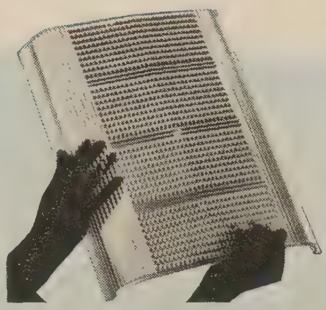
*EXTRACT FROM I.E.S. CODE

"Good lighting requires that the degree of glare be limited to an amount acceptable to the majority of the people using the building"

and again ▶

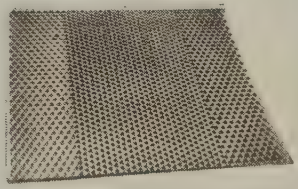
"The degree of glare resulting from direct view of the light sources in an interior depends on a number of factors of which the brightness and area of the sources, their position and the average brightness of the room are the most important"

The new I.E.S. Glare Index requires serious consideration by the user and the designer of lighting installations. Holophane, having proved that their patented systems of optical louvres with integral scientifically graded brightness patterns are of the utmost importance in controlling discomfort glare, will be glad to send details of these ranges of prismatic lens plates to all bona fide enquirers. There is no obligation.



HOLOFLUX: "Lumiplex" (BZ 3)

A series of plastic moulded louvres with unique prismatic features for full control of tubular fluorescent lamps.

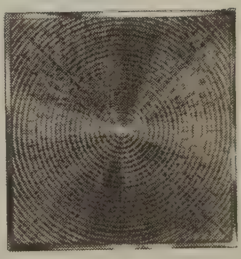


HOLOCON: (BZ 2)

High quality optical lens with patterns of conical prisms for flush mounting fittings, particularly at low mounting heights, using MCF/U lamps.

CONTROLENS: LENTILITE: (BZ 1 to 5)

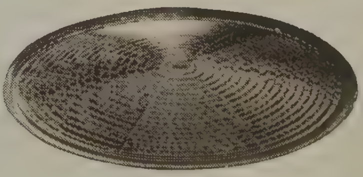
Prismatic glass plates with optical characteristics and properties of a lens, for a variety of light distributions.



HOLOPHANE LTD

SCIENTIFIC ILLUMINATING ENGINEERS SINCE 1896

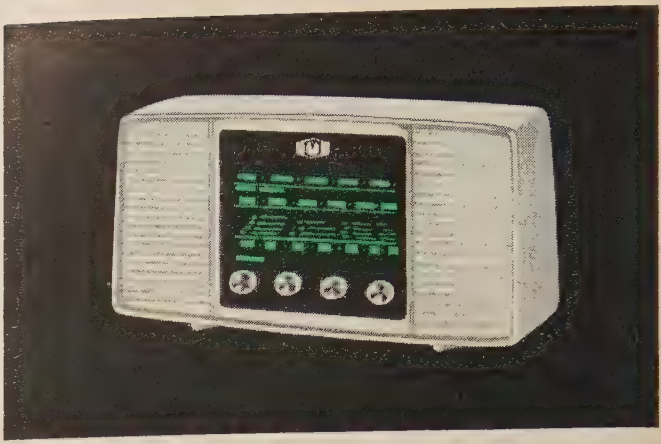
Elverton Street, Westminster London, S.W.1.
Telephone: VICtoria 8062

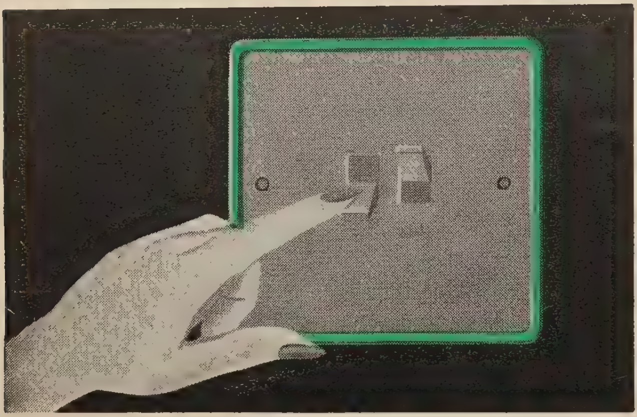


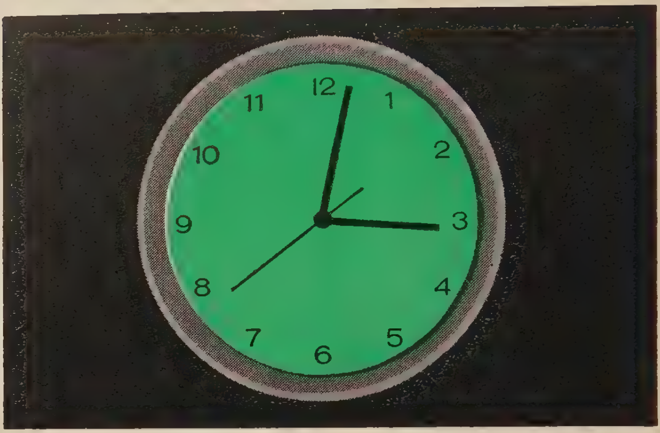
LOUVRELENS: (BZ 1)

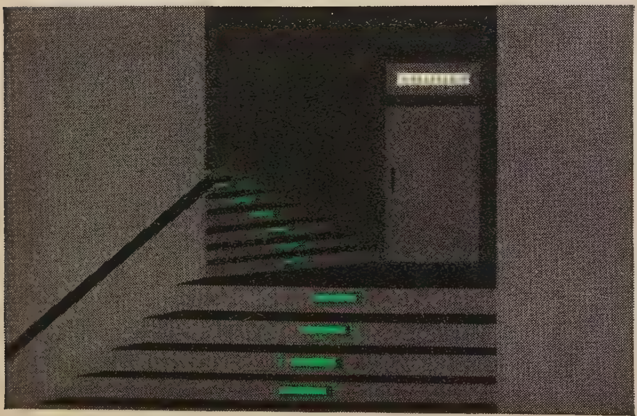
Specially designed prismatic lens in concave form to give high lighting effects for emphasis, with brightness control.

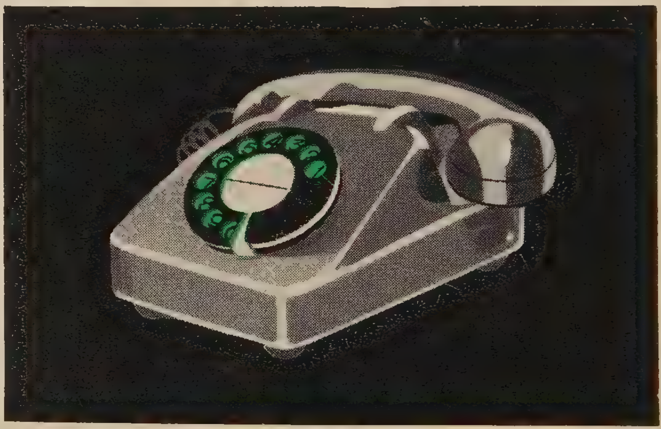
* *The I.E.S. Code for interior lighting, obtainable from:*
The Illuminating Engineering Society,
32 Victoria Street, London, S.W.1. Price 12/6d.











THORN PANELUME LAMPS

Thorn Electrical Industries Limited who pioneered the commercial use of electroluminescence in the form of Panelume lamps for aircraft cabin signs, are now able to offer this new light source for domestic applications.

Panelume lamps are rugged, long-life, luminous steel panels that have no filaments, no cathodes, no glass envelopes. They are particularly suitable for incorporating into products which need to be seen in the dark. Other features include:

Surface Brightness – 1 to 3 foot lamberts.
Life Expectation – 40,000 hrs. to half brightness.
Running Costs – 0.3 mA per square inch at 250V AC 50cps (less than 1d. per annum).
Panel Size – Maximum dimensions for a single panel are 10″ x 8″.
Colours Available – Blue and green.

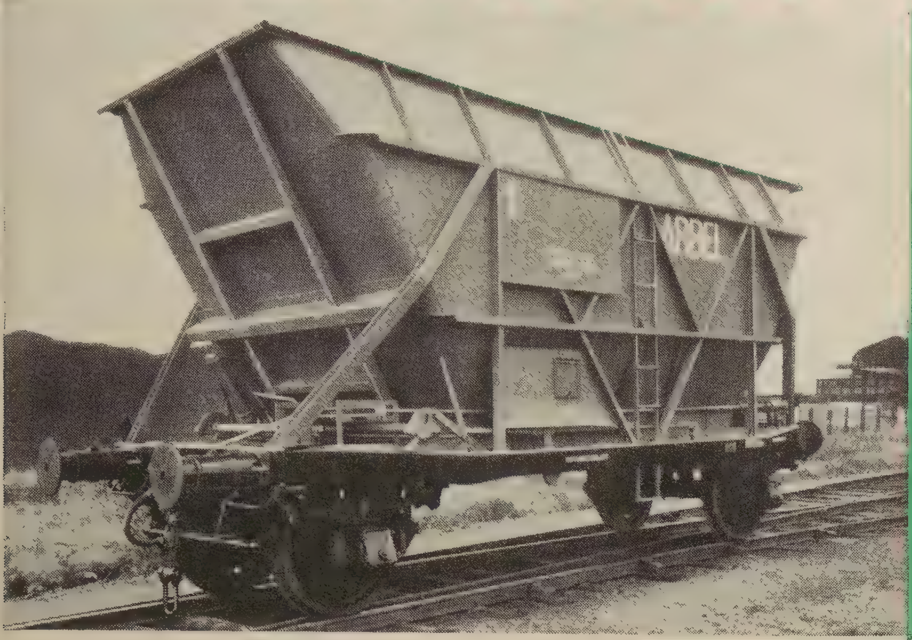
For more information or illustrated brochure write to:

THORN ELECTRICAL INDUSTRIES LIMITED,
Special Products Division, Great Cambridge Road, Enfield, Middlesex. Enfield 5353

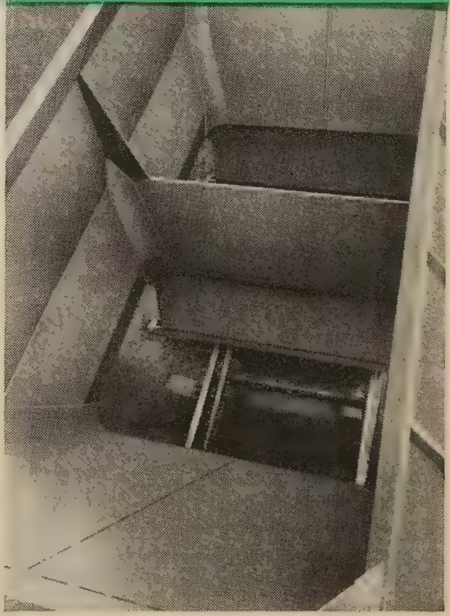
DTV/P

GREER-MERCIER

ACCUMULATORS : NEW PROJECTS



30 TON LOAD EMPTIED IN 3 SECONDS



A NEW APPROACH TO FAST UNLOADING

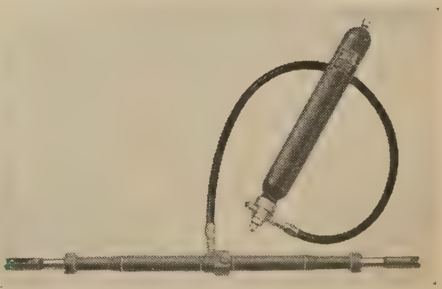
1100 coal wagons operated successfully for over two years by Electricite de France, proves the efficiency of hydraulically-actuated bottom doors. The 30-ton load, when released, slams open the bottom doors, which actuate pistons to store oil under pressure in a hydro-pneumatic Accumulator. Operation of a return lever permits this energy to close the doors automatically. The hand-controlled system used in France is readily convertible to remote control from track side cam-plates.

A 30-ton load fully opens the bottom doors in 0.2 seconds. The wagon is empty in three seconds.

This equipment is now used in France, Spain and Belgium.

For the British Isles and the sterling area, Fawcett Preston supply the complete hydraulic equipment.

FAWCETT



Manufactured under licence from Greer Hydraulics Inc. Covered by British Patents.

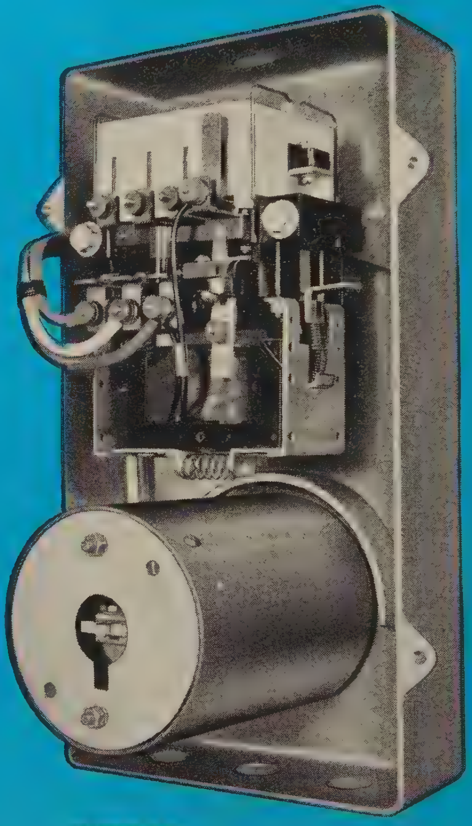
FAWCETT PRESTON & COMPANY LIMITED
BROMBOROUGH, CHESHIRE *Tel: ROCK FERRY 6181*
Branch Offices: London and Birmingham *Metal Industries Group*

FP 200

Introducing a NEW Starter

Type AT689 DIRECT-ON

10 h.p. 380/550 VOLTS



FEATURES

Starter complies with B.S.587-1957.
Contactor tested to B.S.775-1956.
Dust and damp protecting enclosure.
Plug-in thermal overload relay with automatic temperature compensation.
Operating coil easily removed.

EXTRAS

Control circuit fuses.
Ammeter, Selector switch.
Additional auxiliary switches.

DELIVERY EX STOCK. ATTRACTIVE PRICE. Pamphlet R61/5 on request.

M. & C. SWITCHGEAR LTD.

KIRKINTILLOCH, GLASGOW. Phone Kirkintilloch 2216

LONDON
36 Victoria St. S.W.1
Phone ABBEY 6454

SHEFFIELD
Olive Grove Road
Phone 25178

MIDLANDS
12 Perrin Avenue,
Kidderminster
Phone 3106

NORTHWEST
Goughs Lane,
Knutsford
Phone 2445

NEWCASTLE
1 Eldon Square
Phone 25887

CARDIFF
4-5 Mount Stuart Square
Phone 26154

by appointment
To Her Majesty the Queen
Manufacturers and Suppliers of
Electric Cable
Pyrotenax Limited

PERFECTED BY EXPERIENCE
Pyrotenax
m.i. COPPER COVERED CABLE

The use of the name "Pyrotenax" is exclusive to the products of this Company and its associates.

In the changing face of power generation, "Pyrotenax" remains a consistent choice.

A Silver Jubilee does not prove immortality but it is significant that Pyrotenax cables installed in power stations more than twenty years ago are still as efficient as those serving in today's nuclear plants.

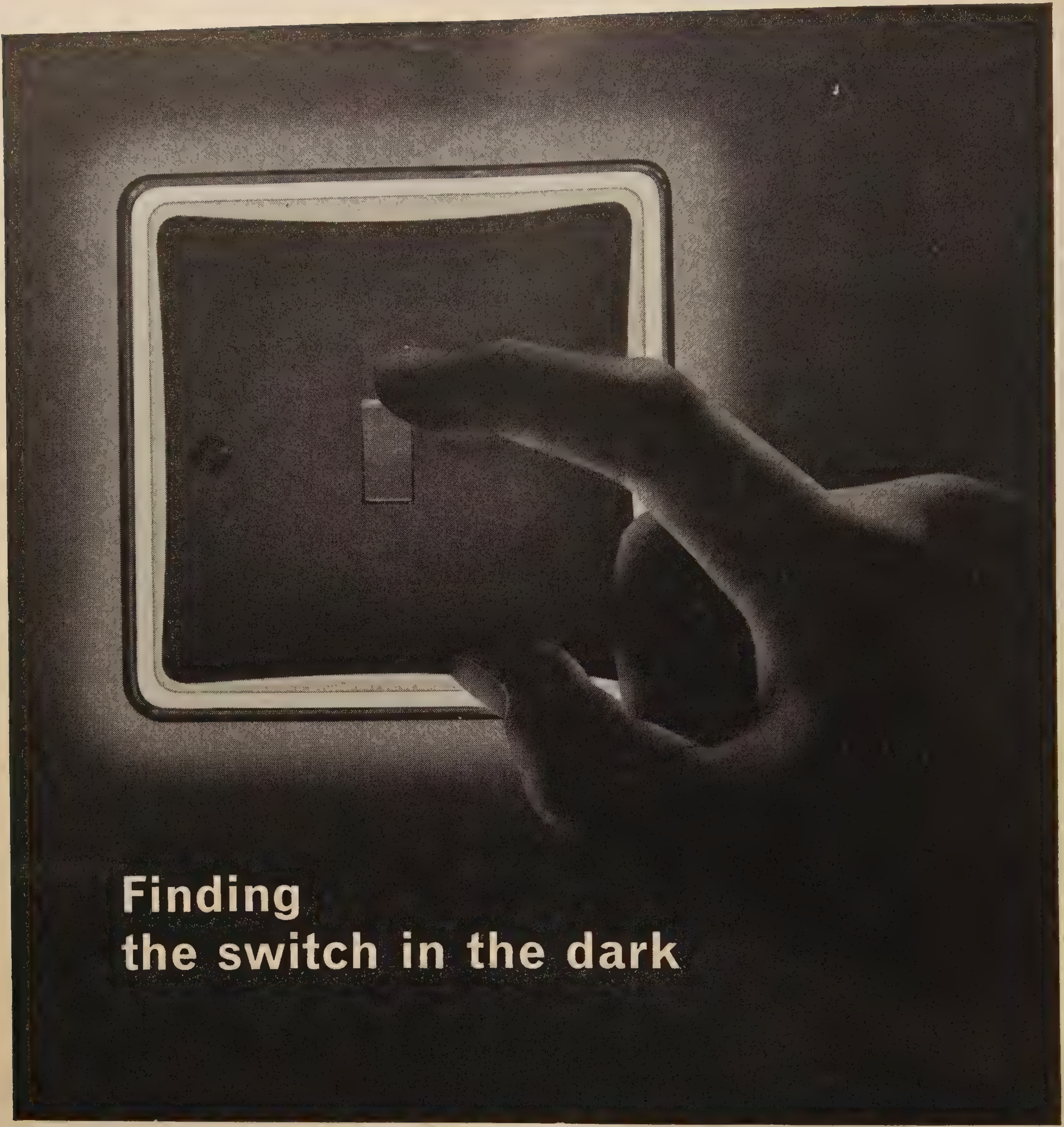
Age means nothing to "Pyrotenax".

The twenty-five years experience behind every Pyrotenax cable represents more than a period of unique manufacturing and user experience in the production of M.I. cable; it is a sort of insurance—with no premium to pay.

PYROTENAX LIMITED · HEBBURN-ON-TYNE · Telephone: Hebburn 83-2244/8

AREA OFFICES AND DEPOTS: LONDON: *VICtoria 3745* **BIRMINGHAM:** *MIDland 2924* **MANCHESTER:** *Deansgate 3346/7* **LEEDS:** *Leeds 27826*
NOTTINGHAM: *Nottingham 89167/8* **GLASGOW:** *City 3641/2* **CARDIFF:** *Cardiff 23689* **SWANSEA:** *Swansea 50901 (Depot only)*

GD 740



MK 218 DHB

MK

LUMINOUS LOCATOR

Groping in the dark to find a switch or socket-outlet frequently results in clashes with furniture and also finger-soiled walls. The solution is to see them, not to 'feel' for them.
The M.K. Luminous Locator is a neat fitment which surrounds any British Standard flush switch or socket-outlet which has two fixing screws on 2⅜″ centres.
Emits in darkness by a practical application of 'Panelume' electroluminescence a bright glow which completely surrounds the switch or socket-outlet. Reverts in daylight to ivory colour, in harmony with any decor.
Current consumption is only 0.3 mA, and life expectancy is almost everlasting.
An essential fitment for all switches and socket-outlets which are fitted in halls, corridors, landings and bedrooms of domestic properties, and with many applications in hotels, offices, hospitals, etc.
Watch for our forthcoming announcements appearing in Ideal Home, House Beautiful, Good Housekeeping and Homes and Gardens and be ready to meet the demand!

Have you received copies of our new Leaflet 260?

M. K. ELECTRIC LIMITED, EDMONTON, LONDON N.9 TEL: EDMonton 5151

ELECTRICAL REVIEW

Ninetieth Year of Publication

Friday 15 December 1961 Volume 169 No 24

IN THIS ISSUE

943 Power Plant Design

In the quest for increasing thermal efficiency of operation and lower costs of construction the sizes of turbo-generator/boiler units are being steadily increased

945 The Control of Nuclear Power Stations

Messrs. B. H. Stonehouse and A. J. Spurgin, of the United Power Co., Ltd., discuss the control of nuclear power stations feeding into the British grid. It is considered that these stations should make some contribution to system stability even if this is obtained by using the thermal energy stored in the steam-raising units, leaving the reactor output constant

950 Development of Large Turbine-Boiler Units

Generators of 500 MW now form the bulk of the construction programme of the Central Electricity Generating Board. In a paper presented to the Institute of Marine Engineers this week Messrs. F. Dransfield and J. L. Gray of the C.E.G.B. deal with the progress made in the design of modern steam plant

957 An Oscillating Synchronous Linear Machine

Summary of a paper by Dr. E. R. Laithwaite and Mr. R. S. Mamak read at an I.E.E. Utilisation Section meeting yesterday (Thursday) in which the possibilities of a direct electrical oscillating drive are discussed

960 Cross-Channel Cable

Official inauguration of the 200 kV d.c. link between the British and French power systems

973 Aluminium Cable Manufacture

The new factory of the Aluminium Wire & Cable Co., Ltd., at Jersey Marine, near Swansea, enables the company to offer a complete range of Solidal p.v.c.-insulated power cables

975 Electrolytic Tinning Line

Designed to operate at up to 1,500 ft/min, a new electrolytic tinning line at the Ebbw Vale works of Richard Thomas & Baldwins, Ltd., incorporates a production analyser and a data recorder

NEWS SECTIONS

959 Views on the News
961 Letters to the Editor
963 Personal and Social
965 Industrial News
970 New Electrical Equipment
977 Transformer Laminations
978 Financial Section
982 New Patents
983 Contract Information
984 Next Week's Events
93 *CLASSIFIED ADVERTISEMENTS*
104 *INDEX TO ADVERTISERS*

Managing Editor:
HUGH S. POCOCK, M.I.E.E.

General Editor:
J. H. COSENS

Technical Editor:
A. R. POLLARD, A.M.I.E.E.

Editorial Staff
H. E. A. WILLIS
Chief Sub-Editor
Technical
T. C. J. COGLE
B.SC.(Eng.), A.M.I.C.E., A.M.I.E.E.
T. R. WARREN
D.F.H., Graduate I.E.E.
Industrial
R. F. MASTERS
V. A. HUTCHINSON

Production
D. R. BRAY

Information Department
D. E. SHERRARD

Advertisement Manager
W. R. COOK

Iliffe Electrical Publications Ltd.
Managing Director H. S. Pocock, M.I.E.E.
Dorset House Stamford Street London SE1
Telephone Waterloo 3333
Telegrams Elecrev, London, Telex
Cables Elecrev, London, SE1 *Code* ABC

Please address correspondence to **Editor, Advertisement Manager, or Publisher,** as appropriate. Published weekly (Fridays). Registered at the General Post Office as a Newspaper. Entered as Second Class Matter at the New York, U.S.A., Post Office. Price: 1s 6d per copy. Annual Subscription: Home £4 0s 0d; Overseas £5 15s 0d; U.S.A. and Canada $16.00. Remittances payable to " Electrical Review."

© Iliffe Electrical Publications Ltd. 1961. Permission in writing from the Editor must first be obtained before letterpress or illustrations are reproduced from this journal. Brief abstracts or comments are allowed provided acknowledgment to the journal is given.

Another of our specials

ELECTRICAL AND REMOTE CONTROL EQUIPMENT

Tailor made to YOUR specification or engineered and designed for YOU

Flush mounting instruments
and circuit breakers
housed in separate compartments

Designed for
parallel operation of private
generating station with the grid system

ALTERNATOR CONTROL AND DISTRIBUTION PANEL

Field & Grant BIRMINGHAM

The Mark of the Specialist

Field & Grant LTD.

KENT STREET • BIRMINGHAM 5

Phones: MIDLAND 8574-5-6 LONDON, HARROW 5578 SHEFFIELD 345967

CHANNEL "Spring Capped" CONDUIT

ELECTRICAL TRUNKING

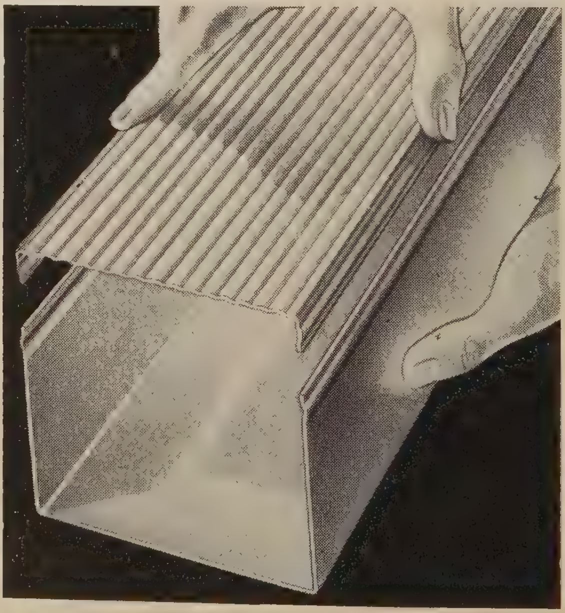
saves time, money & trouble

- * Easier and cheaper to install.
- * Wiring instantly accessible for maintenance.
- * Ideal for power, lighting, telephone and intercommunication systems.

Available in the following sizes:

1″ × ½″, 1″ × 1″, 2″ × 1″, 2″ × 2″, 3″ × 2″, 3″ × 3″, 4″ × 3″ and 4″ × 4″

CHANNEL
"Spring Capped"
CONDUIT



Write or telephone for Publication No. RA230

CHANNEL CONDUITS LTD., STATION ROAD
WINSLOW, BLETCHLEY, BUCKS
Telephone: Winslow 337

RA 230

ELECTRICAL REVIEW

15 December 1961 Vol. 169 No. 24 Established 1872

Power Plant Design

DURING the last few years only the very largest practical sizes of turbo-generator/boiler units have been installed in the new power stations constructed by the Central Electricity Generating Board. This policy is an economic one for it has been proved that as unit capacity increases the capital cost per kW of installed plant decreases in almost direct proportion. Roughly speaking, this decrease amounts to about 20 per cent for a doubling in the size of the plant. In 1953, for instance, a plant consisting of six 30 MW sets cost £63/kW, whereas in 1959 a station accommodating five 200 MW sets cost only £49/kW.

Apart from these considerations costs have also been reduced during recent years by other and more detailed improvements in design. With the larger units it is also possible to increase the thermal efficiency of operation by the use of the reheat cycle. The position has now been reached where the " standard " machines are 120 MW and 200 MW reheat units, and even these figures will soon be surpassed as very much larger units, up to 550 MW, are in course of construction. There must be a limit to unit sizes, however, because of transport difficulties and the maximum economic size of individual units connected to the grid system. The latter point may not worry us unduly in this country since it has been estimated that a network can withstand the loss of a unit rated at up to 10 per cent of the system capacity.

Electricity produced by the larger turbo-generator/boiler units is much cheaper than that obtained from smaller and therefore older plant. Because of this the newest units are almost exclusively employed to meet base loads. When the civil nuclear power stations now under construction are in commercial operation and the older smaller conventional sets have been dismantled, it will obviously become necessary for many larger units to be operated on peak loads. In recognition of this fact, the British turbine and boiler manufacturers are designing their plant so that it will be suitable for rapid starting. The aim is to produce units which are capable of being started up from cold boiler conditions and of delivering full load to the network within one hour. At the same time all larger units are still being designed to operate at their maximum efficiency at maximum continuous rating. This is because it is considered that there will be sufficient numbers of such sets connected to the system to allow for the shutting-down of complete units during off-peak periods.

The design and construction of generating plant has reached a most interesting stage of development and some of the major problems encountered and the means found to solve them are reviewed in a paper presented by Messrs. F. Dransfield and J. L. Gray to the Institute of Marine Engineers (see page 950). On the trend towards increasing unit capacity, it is pointed out that the saving of materials which is a direct result means that there is a reduction in the inertia relative to the power output of the machine. This gives rise to some nice problems in the design of governor gear, and during the past decade the speeds of response of both automatic voltage regulators and turbine governors have had to be greatly improved.

MONEY FOR SUPPLY DEVELOPMENT

The need for an increase in the borrowing powers of the Electricity Council and Area Boards was foreshadowed in the Council's annual report. The limit fixed in 1959 is now expected to be reached by the end of the year, although capital requirements have been slightly lower than forecast. But during the next four years total investment will be raised and capital requirements for the period 1958-1965 are expected to be £210 million more than originally estimated. Last month it was stated that well over 12,000 MW of new plant would be commissioned between 1961-65 and that proposals for a further increase, involving extra expenditure next year, were under consideration.

Of principal interest in last week's White Paper (see page 965) is the confirmation that the Electricity Council will aim to provide the additional capital. Between vesting day and 1958 the industry provided for about one-third of its capital needs. Recently a level of about 48·6 per cent has been achieved and this is now to be raised during the next four years to " about 50 per cent " and perhaps beyond. One result of this is that existing consumers will bear a greater proportion of the costs of development to meet future demand. It also makes it increasingly urgent to find some better way of presenting the industry's financial results. The " surplus " is an essential contribution from revenue towards capital development, not something over and above the industry's requirements.

REFRIGERATOR IMPORTS

The Merchandise Marks Act is an effective measure of consumer protection. It avoids discrimination and restriction and traders have no good grounds for complaint at being obliged to describe accurately the goods they sell. A purchaser of a refrigerator, for example, can reasonably ask to know the origin of the appliance as this may affect the availability of spare parts, but it would be unfair to insist that the importer mark his goods in a way that might make them more difficult to sell. Style and appearance are of increasing importance in refrigerator design. The Standing Committee on Refrigerators therefore acted wisely in rejecting the more stringent demands of British manufacturers and the Committee's recommendation on marking to the Board of Trade is a sensible compromise. Restrictive regulations can be a more effective barrier to trade than tariffs and the aim should not be to introduce new ones but to set an example by getting rid of those that exist. This does not mean that we should not insist on adequate standards of quality and safety.

The level of refrigerator imports has now fallen and the " flood " has in any case been small compared with British production for the home market (see page 966). Imported refrigerators have, however, found new retail outlets and British manufacturers are apprehensive of the situation that will arise when Britain joins the Common Market. But if the refrigerator business in this country is in fact going to be " knocked sideways," as Mr. C. A. Ganderton (A.E.I.-Hotpoint) has suggested, there surely must be something radically wrong with the models that British manufacturers are now offering.

COAL BY PIPELINE

One of the research subjects which the Central Electricity Generating Board is pursuing is the hydraulic transport of coal from mine to power station. Many technical problems have to be surmounted and there is, of course, also the economic aspect. Two design studies are in hand: one a mile-long pipeline between mine and power station and the other a scheme for pumping coal over a distance of 150 miles.

A scheme described in the *Electrical World* (New York) is of the latter kind; 108 miles of 10in pipeline was used for transmitting slurry to the E. H. Werner station of the Jersey Central Power & Light Co., where it was fired as a 70 per cent coal 30 per cent water mixture without de-watering. Apparently the pipeline has been in use since 1957, moving an average of 160 tons of coal an hour but this has been treated in a filtering and thermal drying plant to convert the mixture to 8 per cent moisture coal for firing.

POWER ENGINEERS' CLAIM

When the manual workers in the electricity supply industry were given their recent increase in wages it was widely asserted that this was the end of the Chancellor's " pay pause " and the beginning of a general demand for more money. Now within the supply industry itself that prophecy is being fulfilled: the Electrical Power Engineers' Association, says its official journal, " is to table an independent, comprehensive all-round claim at the earliest possible date." Agreed recommendations are to be considered at a special meeting of the Association's National Executive Council in February with a view to placing them immediately before the National Joint Board for the industry. That will probably be in March and the delay may carry the claim over the " pause " period which, it is thought (on not very firm grounds), may end in April. Of course the E.P.E.A. understands probably better than some other trade unions that a general rise in remuneration leaves the " beneficiaries " no better off in real terms, but in the absence of any national policy in the matter the Association is bound to keep up with the rest.

The Control of NUCLEAR POWER STATIONS

By B. H. STONEHOUSE, B.Sc.(Eng.), A.M.I.E.E.
and A. J. SPURGIN, B.Sc.(Eng.), Grad.I.Mech.E.*

The design of the control system of a power station, whether it be hydro-electric, coal-fired, or nuclear, must take into account the characteristics of the electrical network into which the output will be fed and the load demands on the station. In this article the control of nuclear power stations feeding into the British grid is considered

IT will be appreciated that on any grid network the summated station outputs and the varying system load have to be kept in a condition of balance, as the only significant energy storage in the network is in the rotating inertia of the generators and the loads. The normal method of operating any electricity supply network is to run the more economical stations at near their maximum output, using selected stations to control the system frequency and the loading on the system interconnectors. For some years, nuclear power stations will undoubtedly be used primarily for base-load purposes, owing to their lower fuel charges. In practice, also, the cost of fuel per kWh generated in a nuclear station may well rise if it is run on a variable output basis.

Frequency Variations

The frequency of the British grid network is subject to small but continuous variations which tend to reach a maximum at times of light load. The variations may be typified by assuming a sine wave of 0·02 c/s amplitude and 1·5 min period. Larger swings in system frequency take place principally in the morning and evening, and these may be typified by an oscillation of 0·11 c/s amplitude and 50 min period. Only a few of the larger cycles will take place during any one day.

Under system fault conditions such as the tripping of inter-area feeders, the loss of a power station output, a large load, or the tripping of a large set under system light load conditions, rapid variations of system frequency occur. It is desirable to reduce these variations to the minimum and to ensure that the system remains in stable operation. These results are normally obtained by the use of frequency-sensitive governors on the steam turbines, which operate to increase or reduce the turbine output as is required. Control schemes for nuclear power stations have been produced which provide a constant output independent of system frequency. It is considered desirable, however, that the nuclear stations should make some contribution to system stability, even if this is obtained by using the thermal energy stored in the steam-raising units, leaving the reactor output constant. This method of operation is acceptable for transients lasting for a period of a few minutes.

In the event of the isolation of the station from the grid system or connection only to a local load, it is desirable that the station output should be frequency-sensitive if frequency stability is to be maintained. In this mode of operation it is further desirable that the reactor output should be matched to the turbine demand.

Though present-day nuclear stations are designed primarily for base-load operations, it is considered desirable to incorporate a certain degree of flexibility in the control equipment, and the combined station/network performance is studied under the following headings:—(a) Minute-to-minute frequency variations; (b) daily frequency variations in the system; (c) system fault conditions; and (d) station operation when disconnected from the main grid network.

Control Problems

Nuclear power station economics demand high fuel burn-ups and long irradiation times. Under these conditions the fuel element life may be sensitive to the amount of temperature cycling to which the elements are subjected. The number and magnitude of the temperature cycles are naturally dependent on the control equipment employed, but it is generally true that all the fuel will be subject to temperature changes during start-up and large load changes. Additionally, a small number of fuel elements in channels adjacent to the position of operation will be affected by such operations as the movement of automatically-actuated control rods, fuel changing on load, and control rod maintenance.

The variations of load to which a nuclear station may be subjected are also influenced by transient build-up of xenon poisoning in the fuel following a load reduction. If a reactor is very rapidly shut down from full-load conditions, the xenon poisoning transient and the changes in fuel element and core temperatures will normally make it impossible to re-start the reactor for a period of between 15 and 30 hours, dependent on the reactor design. The controls of most present reactors are designed so as to compensate for the changes in reactivity that follow the throw-off of load due to the tripping of one main turbine, and many reactors can continue in operation for load reductions down to below 50 per cent of full power. It is possible to design reactors so as to eliminate the xenon poisoning restriction on their load cycle, but the increased capital cost of a larger core size and fuel element investment is not normally considered justified for electricity generating stations.

---

* Both authors are with the United Power Co., Ltd.

There are thus two conflicting requirements for the performance of the output control apparatus for a nuclear power station. It is desirable that the output should be automatically variable to take into account system stability requirements, and yet it should not produce temperature changes in the reactor due to load variations. Herein lies the conflict, and various solutions to this problem have been produced.

Station Control System

The control of the station as a unit is achieved by several control loops in cascade and some interacting loops, though usually the degree of interaction is small. The quantities used for and by the various control loops are:—(a) Reactivity of the reactor; (b) gas flow through the core; (c) gas inlet and outlet temperatures; (d) feed water supply to the steam raising units; (e) steam flow to the turbo-generators; and (f) excitation of the generators.

The methods of controlling the feed water flow and the electrical output of the alternator follow normal conventional practice and will not be considered further.

Reactivity Control

The causes of regional instabilities in reactor neutron flux, and hence in local power generation in the core, have been discussed previously.[1,2] To control these instabilities, the reactor core, which is roughly cylindrical, is divided into several control regions—typically a central cylindrical one surrounded by eight radial zones. When the core reactivity balance is kept at a required level, the reactor output is constant. This steady state is detected in each region by means of thermocouples placed in the gas stream at the top of individual fuel element channels, and the control rods are automatically actuated in each region to maintain outlet gas temperature constant. Automatic controls not only inhibit any tendency to flux instability, but also reduce to the minimum the number of fuel elements subject to temperature transients.

The control equipment for one radial zone is shown in Fig. 1, and comprises a reference temperature setting unit, a control station which is positioned on the main control room panels, a thermocouple amplifier, and a controller which supplies a power servo indirectly driving the control rods.

The controller characteristics are shown in Fig. 2. These characteristics may be considered in three parts, as follows:—

(i) *Dead Band.* This can be set in the range 0·5 to 5°C with an accuracy of ±0·2°C. This dead band is provided so that the controller does not respond to minor random variations in temperature (of the order of ±0·25°C). If the equipment responded to such minor changes, the wear on components, particularly on the control rod actuators, might be significant.

(ii) *Linear Control.* In this region the rod speed is proportional to the temperature error above the dead band setting.

(iii) *Rod Speed Saturation.* The precise maximum speed in this region is determined by consideration of reactor safety. A typical saturation speed would correspond to a rate of 1 mN/s (milli Nile per second, a measure of reactivity or departure from criticality), when all controllers were simultaneously in operation. The temperature error at which saturation takes place is directly related to the slope of the controller characteristic and the saturation rate (see Fig. 2).

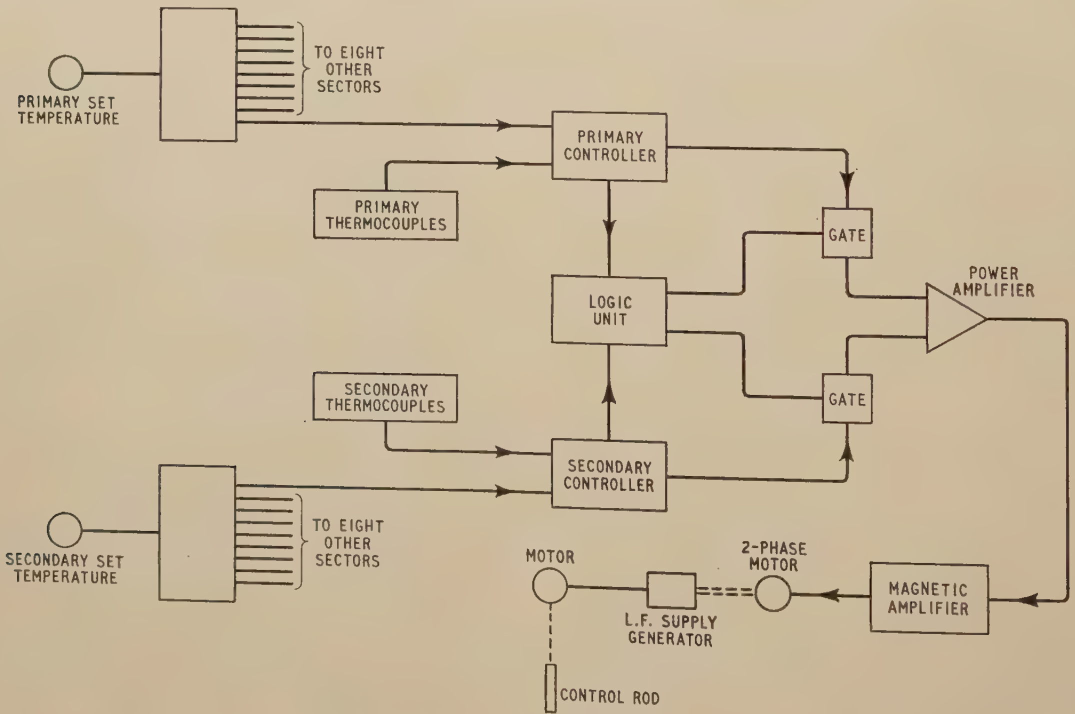


Fig. 1.—Schematic diagram for one sector controller

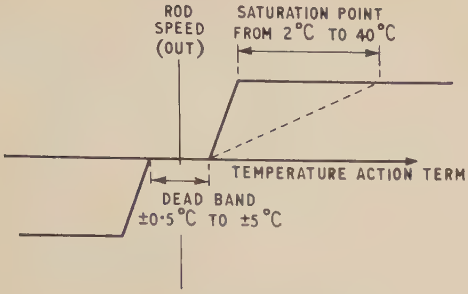


Fig. 2.—Controller characteristic

One of the principal factors influencing the stability of the reactor controller system is the thermocouple time constant, which is 4-5 seconds at full flow, increasing rapidly at reduced rates of flow. To ensure stability under all reactor operating conditions, the gain of the controller (as measured by the slope of the proportional characteristic) is varied according to the reactor coolant flow.

To improve the stability further, a derivative term is added to the temperature error term in the controller. The overall specified long-term drift due to ambient changes and supply voltage and frequency variations is ±1°C.

The reference temperature setting unit is used primarily during the start-up of a reactor to control the rate of temperature rise, the actual rate of rise being variable over the range 0-3°C per minute. The unit comprises a series of ganged multi-turn potentiometers, the characteristics of which are adjusted to correspond to the millivolt temperature characteristics of the thermocouples. The potentiometers are driven by a servo system which operates at the required rate of change to produce final demand temperature.

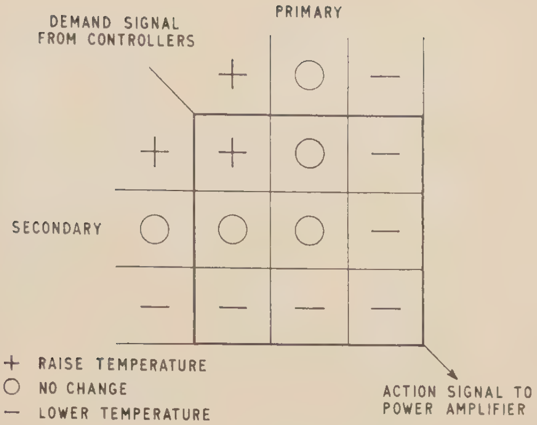
For each sector, two complete sets of control equipment are provided up to the power amplifier that feeds the control rod motor servo unit. The combined operation of the two sets of equipment is governed by a logic unit, which works as shown in Fig. 3. The logic has been designed to ensure that the operation is as far as possible "fail-safe." Either controller may operate to reduce the outlet gas temperature, but they have to be in agreement on the action to be taken before the temperature can be raised.

In the event of an open circuit or short circuit in the thermocouple leads, or during refuelling operations on a channel in which a control gas outlet thermocouple is sited, the net output signal falls. The logic used ensures that the control action is correctly maintained by the second unit without the need for any switching or adjustment.

Flow Control

Under normal conditions, the gas temperature at the inlet to the reactor falls to a slight extent with decreasing reactor output.

Thus, since the outlet gas temperature is maintained constant the power output of the reactor is roughly proportional to the flow once normal operating conditions have been established. Hence, the reactor output can be varied by changing the circulator speed.


DEMAND SIGNAL FROM CONTROLLERS
PRIMARY
SECONDARY
ACTION SIGNAL TO POWER AMPLIFIER

	+	○	—
+	+	○	—
○	○	○	—
—	—	—	—

+ RAISE TEMPERATURE
○ NO CHANGE
— LOWER TEMPERATURE

Fig. 3.—Controller logic

Subsequent sections of this article consider various governor characteristics for the turbo-generators and many of the schemes discussed result in the automatic changing of the turbo-generator load. Unless these changes are to be of relatively short duration, the reactor output must be adjusted to suit the revised conditions. If such adjustment of reactor output is not made, the steam pressures will fluctuate violently, because of the relatively small thermal capacity and steam storage of the steam raising units and pipework. In practice, variations in steam pressure, or steam pressure and flow combined, are used to detect mis-match between the reactor output and the required output of the turbo-generator.

One scheme designed for use on a station with steam turbine driven gas circulators is shown in Fig. 4. The steam pressure transducer used is of the force balanced type working over a limited range, typically ±50 p.s.i., about 550 p.s.i. The suppression of the transducer range is carried out partly by dead weights and partly by an electrical signal. This method combines the stability

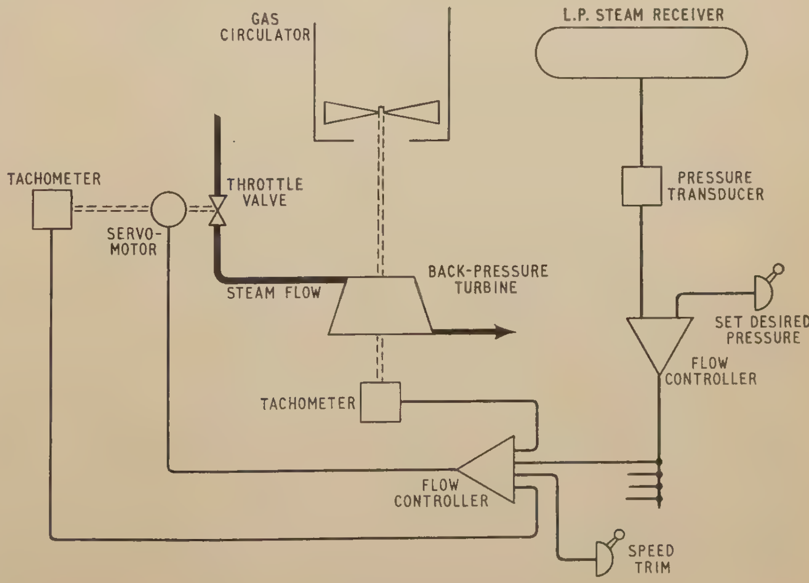


Fig. 4.—Flow control scheme

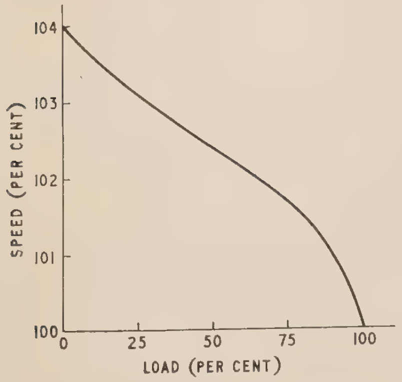


Fig. 5.—Characteristic curve of load variation with speed for a typical dual pressure turbo-generator

of dead weight suppression with the flexibility of electrical variation of the set point.

The transducer output is compared with a required pressure reference signal, and the error fed to a three-term transistor controller. The controller gain is arranged to be lower for small errors, so as to reduce to the minimum small fluctuations in gas flow through the reactor, as these tend to result in undesirable fluctuations in fuel element temperature.

The output of the controller is fed to a separate speed control servo for each gas circulator. This arrangement permits a degree of isolation between the circulator control systems, and hence reduces the magnitude of equipment-fault transients on the reactor.

The use of tachometer feedback into a magnetic amplifier makes the control of the circulators independent of variations in steam outlet pressure and inlet pressure and temperature. An a.c. servo motor drives the circulator throttle valves so that the maximum rate of change of the circulator speed is limited. Values in the range 1-5 per cent of full-load flow per minute are normally used. These values give adequate operational flexibility, whilst ensuring reactor safety. The reactivity control gear can maintain approximately constant reactor temperature conditions during such a rate of change of flow. Alternative control windings are provided on the magnetic amplifiers for trimming the speed of individual gas circulators and for hand control during reactor start-up.

The satisfactory operation of this equipment is very desirable for ease of station operation and for the minimum temperature cycling of the fuel elements. For this reason, a duplicate steam pressure transducer is provided, and allied with this is a monitoring channel. This channel compares the actual steam pressure with the required steam pressure and raises an alarm in the event of serious deviations. This equipment has been made as simple as possible so that it will not affect significantly the overall reliability of the control system.

The bulk of the equipment is designed on a plug-in basis, so that correct operation may be readily restored in the event of equipment faults.

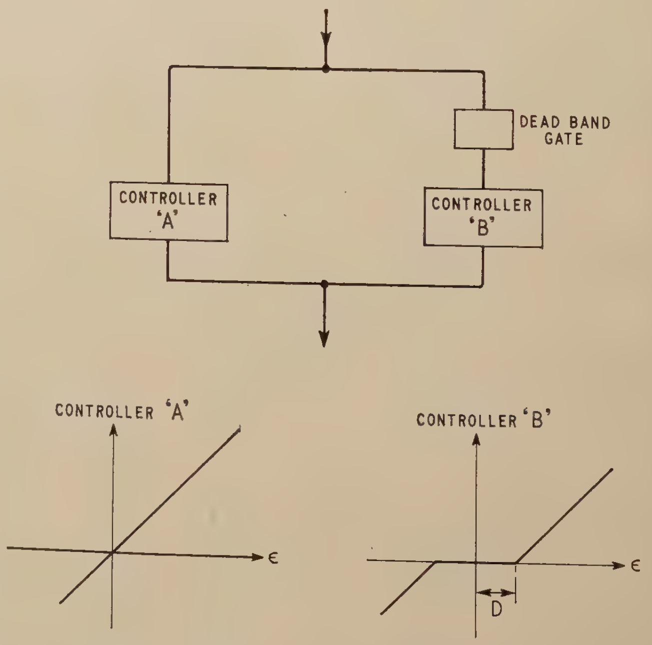
Cold Gas Temperature Control

Small variations occur in the gas inlet temperature with varying load conditions. This situation may be improved by four methods:—(a) Economiser by-pass; (b) control of the feed-water temperature; (c) steam raising unit gas by-pass; and (d) variation of steam pressure.

The first two schemes are those normally employed, as the engineering problems associated with them are easier to solve. Constant gas inlet temperature is normally maintained down to approximately 50 per cent load.

Previously, mention has been made of two modes of reactor operation: operation at constant reactor output, and operation where the reactor output is matched to the requirements of the turbo-generators. At Calder Hall, a control scheme is employed which is typical of the first type of operation. Constant conditions are maintained on the reactor by running the circulators at a constant speed and by maintaining the h.p. and l.p. steam pressures at steady values. The steam pressure control is effected by means of pressure regulating valves which admit the steam to the generators or to the dump condenser. The setting of the pressure regulating valve on the h.p. dump condenser is adjusted slightly above the normal setting of the regulator on the turbine, so that the steam is automatically dumped in the event of a turbine trip. The l.p. steam regulator on the dump condenser is, however, normally set slightly below that of the l.p. regulator on the turbine, as this enables a closer control to be maintained. The reactor inlet gas temperature and the low steam pressure are related. A change of 4 p.s.i. in the steam pressure causes a rise of 1°C in the inlet gas temperature. Close control on the low steam pressure is therefore desirable if constant reactor inlet conditions are to be maintained. From the point of view of a system operator, the principal feature of this method of control is that the station is completely insensitive to any variations in the system frequency.

The station can be made partially responsive to rapid changes in system frequency by modifying the turbo-generator governor gear. Two possible modifications are the use of pressure reset or constant-megawatt-output reset. In both schemes, the turbine is fitted with normal speed-responsive governor gear and the speeder motor setting of the governor is made part of a servo system.



$$f_a = \epsilon + \tau_{D1}\frac{d\epsilon}{dt} + \frac{1}{\tau_{I1}}\int \epsilon\, dt \qquad f_b = \left[(\epsilon \pm D) + \tau_{D2}\frac{d\epsilon}{dt}\right]$$

Fig. 6.—Pressure controller characteristics

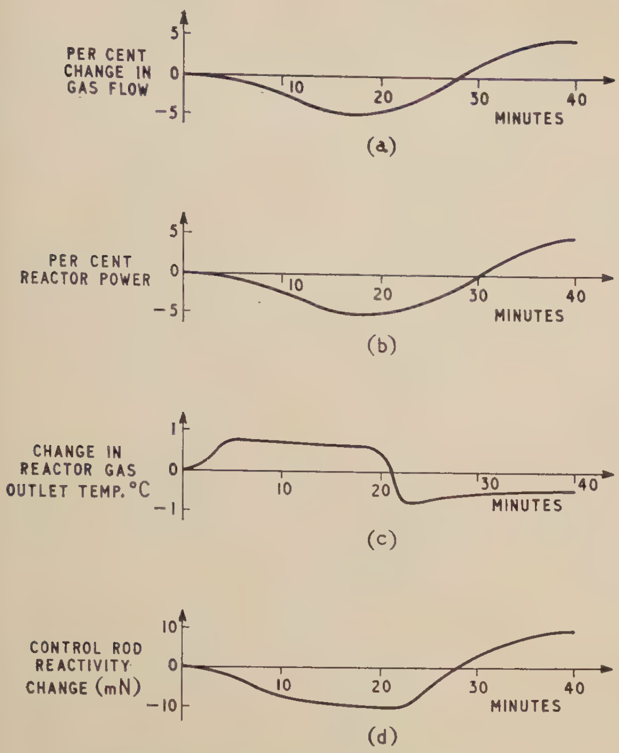


Fig. 7.—Response to a frequency fluctuation of 0·1 c/s in 50 min. (a) Percentage change in gas flow/time. (b) Percentage reactor power/time. (c) Change in reactor gas outlet temperature/time. (d) Control rod reactivity change/time

In schemes based on pressure reset, either the h.p. or l.p. governor gear is fitted with the reset device, and constant pressure governing is used on the other turbine cylinder.

The rate of response of the pressure reset servo on the speeder motor is limited. Under normal slow frequency changes the speeder gear will be reset so as to maintain constant steam pressure and hence constant turbo-generator output. However, the reset gear cannot follow rapid changes in frequency, and under these conditions the output of the generator varies. In the event of a system fault which leads to a significant reduction in system frequency, it will be appreciated that the steam pressure will fall and a certain proportion of the thermal energy stored in the steam raising units will be made available in increased output. This condition cannot persist for more than a few minutes, and at the end of this time the normal turbine pressure unloading gear will come into operation and will automatically start reducing the steam flow and hence the output of the turbine. The scheme has the merit of being relatively simple and of ensuring the minimum of temperature cycling on the fuel elements.

The alternative scheme is based on comparing the megawatt output with a set value, and using the generated error signal to reset the speeder gear motor so as to maintain constant output. Once again, the speed of reset is limited so that the megawatt output varies under conditions of rapidly changing system frequency.

On stations where the reactor output is matched to the turbo-generator demand, the output characteristics of the station are primarily determined by the characteristics of the turbo-generator governing gear. The governing characteristic for a typical dual-pressure set with combined pressure and speed governors is shown in Fig. 5. Whilst the mean characteristic has the normal 4 per cent slope, the actual slope varies from approximately $2\frac{1}{2}$ per cent characteristic at 50 per cent load to 16 per cent characteristic at 100 per cent load. The use of electrical rather than mechanical governors, with the consequent ease of adjustment of the characteristics, could be of value on turbo-generators installed in nuclear power stations.

In the event of a change in system frequency, the generator output will change as dictated by the governor characteristics. Under these conditions the steam generation will no longer match the steam demand, and the change in steam pressure brings the reactor coolant flow control gear into operation as previously described.

The characteristics of a pressure controller are shown in Fig. 6. The low gain of the controller for small pressure deviations ensures that the effects of the small minute-by-minute frequency variations are not reflected in variations of gas flow, but are fully attenuated. With large changes in system frequency, the higher gain characteristics of the pressure controller become effective until, at large errors, the maximum rate of change of flow is obtained. Fig. 7 shows the transient response of some of the station parameters to a frequency fluctuation of 0·1 c/s per 50 minutes. It is observed that for the transient some movement of the automatically-controlled sector rods is necessary, with consequential change in the temperature of some of the fuel elements in adjacent channels. This effect will not be serious, however, unless the load changes are large and occur frequently.

Conclusions

The ultimate choice of the scheme to be employed is an economic one. The cost of the equipment has to be balanced against the economic value of maintaining system frequency stability and of reducing the amount of manual control required from the reactor operator. To these factors has to be added the possible cost of replacing the fuel elements in the channels adjacent to the sector control rods. The final choice of the scheme to be employed will vary with the characteristics of the supply network and the experience gained in the nuclear power stations currently under construction.

REFERENCES

[1] Carstairs, R. L. and Taylor, R. W. "The occurrence and control of spatial instabilities in large reactors." *G.E.C. Atomic Energy Review*, Vol. 2, No. 2 (September, 1959), pp. 89-97.

[2] Carstairs, R. L. and Taylor, R. W. "Reactor radial spatial behaviour." *Nuclear Power*, Vol. 5, No. 50 (June, 1960), pp. 120-122.

MAINTENANCE AT CALDER

THE experience gained during 12 reactor years of operating experience at Calder Hall nuclear power station and some of the problems encountered in maintaining the plant are described in a paper entitled "Maintenance Experience of the Calder Reactors" by J. R. Treharne, A.M.I.Mech.E. This paper was presented to an ordinary meeting of the Institution of Mechanical Engineers held in the Western Branch area at Bristol University on 14th December.

Some comments on the performance of Calder Hall, on the occasion of the fifth anniversary of its commissioning by Her Majesty the Queen, were given in the leader pages of our issue of 20th October last.

DEVELOPMENT OF LARGE TURBINE-BOILER UNITS

A most interesting paper on "Land Practice in Modern Steam Plant" was given by F. Dransfield, B.Sc.(Eng.),* and J. L. Gray, B.Sc.,† to a meeting of the Institute of Marine Engineers on 12th December. With the permission of the Institute, we reproduce a considerable portion of the paper

No competitor of the steam turbine exists for base load plant or, indeed, for any plant having more than a minimum load factor, saving where exceptional technical factors such as shortage of water or a demand for process heat may dictate other solutions. In practice, the peak load plant used in this country is old plant progressively relegated to this duty. The British electricity supply industry operates with three distinct fuels—nuclear, coal and oil—each of which, having a different relationship between its cost as a fuel and the capital cost of its use, dictates a different design of plant from the others. Only the coal- and oil-fired plants will be discussed.

Unit Capacity

Experience and theory suggest that up to the point at which a major change in technical treatment of the design becomes necessary, the cost of plant declines as the size increases. A relationship has been suggested according to which a 20 per cent reduction in cost per kW installed may be realised from each 100 per cent increase in output. Fig. 1 shows the extent to which this relationship appears to have been satisfied by plant actually purchased since 1950.

The incentive to increase the unit output has been a strong one throughout, and has been limited at each stage only by the costs of overcoming certain technical barriers. At each stage the most important limitation has been the difficulty of providing a generator light enough to be transported from factory to site with the somewhat limited facilities available in this country, while maintaining an acceptable efficiency and a reactance which, in conjunction with that of the transformer, will not prejudice the dynamic stability of the electrical system. In this last connection it must be borne in mind that the very feature which makes the large unit attractive, namely the saving in materials which it permits, is expressed in another way as a reduction of inertia relative to the power output of the machine. This greatly increases the governing problem which has had to receive continuous attention throughout the developments reviewed here. The speeds of response of automatic voltage regulators and turbine governors have both been greatly improved in the past ten years, so that, for example, the turbine throttle valves may be closed within less than ¼ sec from the moment of an electrical fault.

The first significant development towards larger generator outputs was the adoption of hydrogen cooling at ½ lb/sq in pressure for the standard 60 MW sets of immediate post-war years. Later the 100 MW sets were developed on similar lines, and 120 MW sets using higher hydrogen pressures. A further increase in hydrogen pressure could not be expected to increase permissible ratings significantly beyond 120 MW, and it became necessary to consider direct cooling of the conductors by hydrogen in the rotor, and by either hydrogen or water in the stator windings together with certain refinements of design details. By these means, the thermal resistance of the electrical insulation was eliminated from the conductor cooling circuit, and a considerable increase in output became possible, culminating in the 500 MW generators which form the bulk of the Central Electricity Generating Board's current construction programme. It should be mentioned, however, that these generators are designed for a greater stator weight than the earlier ones, because of the dispensations which the Ministry of Transport has been able to grant for road haulage of heavy indivisible loads between the generator factories and specified sites in the East Midlands and South Yorkshire coalfields.

At every stage it has been found possible and economically attractive to produce turbine and boiler designs matched to the largest available generator, although at certain stages it has been necessary to accept certain complications because of the current technical limitations of certain details. For example, the length of the retractable

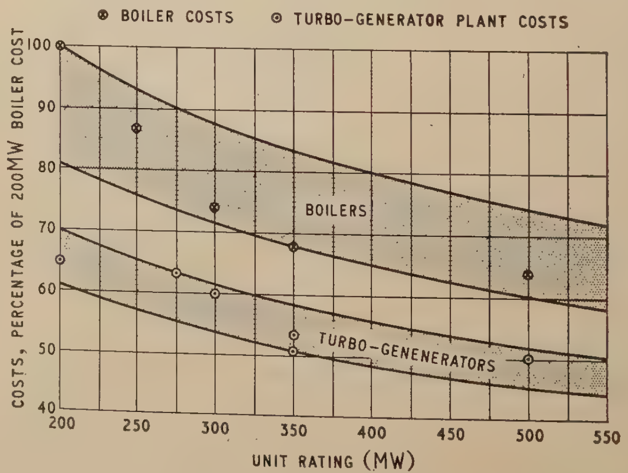


Fig. 1.—Power station main plant costs versus rating (all costs adjusted to a common steam cycle and a common date)

---

* Power Plant Design Engineer, C.E.G.B.

† Turbine Plant Design Engineer, C.E.G.B.

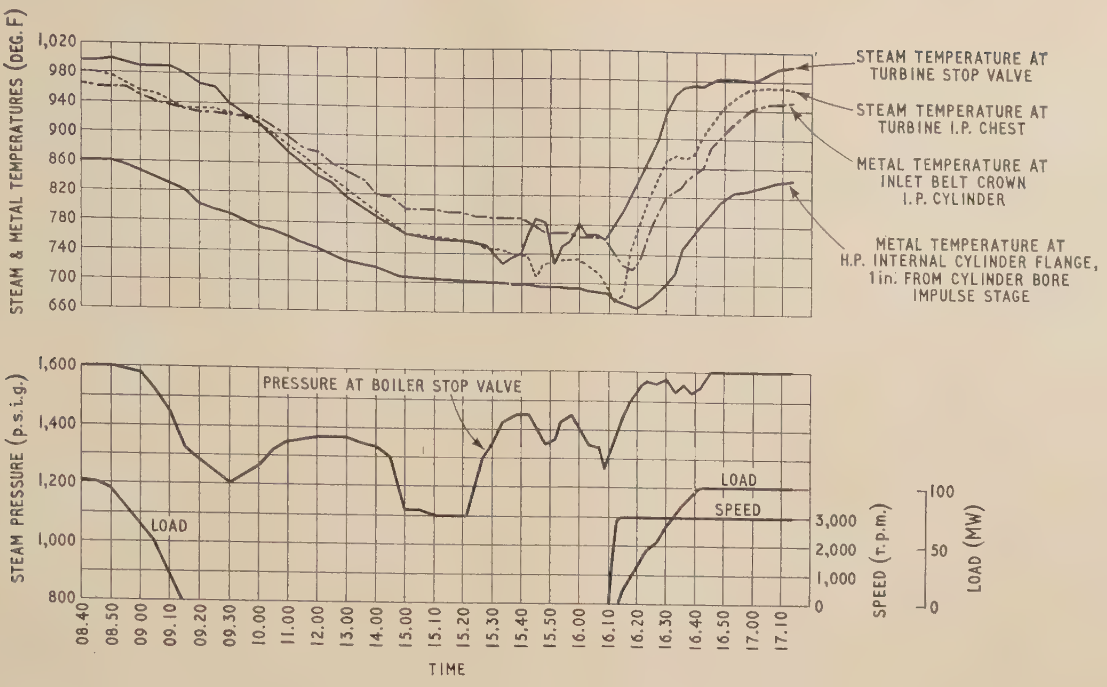


Fig. 2.—Record of shut-down and start-up of a 100 MW reheat unit at Ferrybridge "B" power station

lance soot blower is at present limited to 36ft, and it would be unwise to build a coal-fired boiler in which any part could not be reached by the soot blowers. The limitations on the stressing of the turbine rotors have forced the multiplication of flows in parallel, especially towards the exhaust end, even with the largest rotors now on order which have blading 36in long with 136in tip diameter, running at 3,000 r.p.m.

Unit System

The matching of boiler and turbine capacities opens the way to a substantial saving in capital and operating costs by application of the unit system in which a turbine and boiler have no connection with steam or feed water to other units. The savings arise from elimination of the interconnecting ranges of pipework with valves, application of the largest available boilers and elimination of spare boiler capacity. A plant arranged in this way has the advantage that it can be started up and shut down more conveniently than one with multiple interconnections. It is envisaged that after an overnight shutdown any large unit will be capable of being started from first lighting of the oil ignition burners to full load on the turbine within the hour.

The necessity for this arises from the fact that before many years have passed the nuclear stations of the Generating Board will take a major part of the base load of the system, and it will be economically necessary for the coal- and oil-fired units to be shut down at periods of light load, e.g. at night and at week-ends. Abroad, it is common practice to design turbines and boilers to run at reduced load with reasonable efficiency, but this is achieved at the cost of complication and extra capital expenditure. Virtually all large units in this country are designed to give maximum efficiency at their continuous maximum rating. There is a sufficient number of units connected to the system to allow for the shutting down of complete units during off-peak periods.

The resulting simplification is expressed, for example, in the restricted range of 70 to 100 per cent load over which the boiler is designed to give constant steam temperature (where there is a considerable amount of radiant superheater surface, a wider range than this is achieved naturally and is accepted, but it is not used to any great extent). The turbines again are provided with a simple throttle control without multiple-nozzle control valves. The casing and the temperature distribution within it are therefore simple, and as nearly as may be symmetrical, so that thermal stresses and distortions on changing load are minimised.

It is the Board's practice to submit selected prototype units to a very thorough testing programme to determine what physical limits exist during intermittent running. This both checks the design concepts and enables the operators to determine their most economic starting operation. Fig. 2 shows a summary of the record of one such test of a 100 MW unit. This is perhaps the first time in history that boiler makers and turbine makers have had to consider seriously the starting condition at the design stage. Designing purely for the running conditions, and leaving the starting conditions to be arrived at when the job was commissioned, has notoriously led to difficulties with temperature gradients in such thick walls as those of boiler drums and turbine cylinders, and with excessive temperatures in superheater tubes.

Boiler Availability

The economic justification of the unit system depends on the fact that boiler availability has now been brought up to equal that of the turbine. To meet this requirement the boiler design has had to be adapted to cope with the low-grade coals which constitute about 90 per cent of the Generating Board's fuel supply. The ash has a high alkali content, often combined with a moderate or high sulphur content which leads to deposits which can rapidly block a boiler. These deposits tend to bond on to the surfaces of tubes, and are not easy to remove once established.

The relatively low ash fusion temperatures in these coals make it imperative that the gas temperature leaving the furnace be adjusted to be below the softening point of the ash if sintering and clinkering on the convection surfaces are to be avoided. It is usual to try to design the gas temperature entering the convection bank at 50°C below the ash softening point. This condition has not been easily met in designs for reheat boilers at high temperatures and pressures, since the amount of heat which can be taken up by the water is less than 50 per cent of the total heat input. This means that the furnace cannot be fully water cooled and that the furnace exit gas temperature has had to be reduced by the introduction of either radiant superheaters in the walls or superheater platen surfaces in the upper part of the furnace.

The best furnace ratings it has been found possible to accept, even on an oil-fired unit, are 95,000 B.Th.U./sq ft/hr of projected surface and 27,000 B.Th.U./cu ft/hr on a 120 MW boiler of 860,000 lb/hr evaporation. The corresponding maximum figures for coal-fired furnaces are 75,000 B.Th.U./sq ft/hr and 19,000 B.Th.U./cu ft/hr respectively. The limiting criterion is always the amount of cooling surface that can be accommodated, the volume rating follows. On coal firing a secondary check is taken to see that the average burn-out time of any particle before it enters the convection surface is not less than two seconds. Research is directed to improving this time.

Gas velocities in coal-fired units are kept low to avoid particles sticking on the hot zone convection tubes, and to prevent erosion in the cooler zones, the limiting velocities being 30ft/sec and 60ft/sec respectively. Even with the latter care must be taken to avoid bends and baffles which lead to undesirable local dust concentration. In fact internal baffles, except in a direction parallel with the flow, are largely eliminated. Consequently most of the heating surface is effective. Higher velocities are, of course, possible in oil firing.

Under certain conditions of temperature and sulphur content the alkali content of the ash can lead also to corrosion troubles, even on austenitic and high chromium steels, and this appears to be at the maximum at about 1,150°F metal temperature. The incidence of the attack appears, however, to be also correlated with gas temperature, and is reduced if the gas temperature can be kept relatively low at the point of highest metal temperature. It is the practice, therefore, to put the superheater in parallel flow on the highest temperature section, and to keep this within the convection bank away from the furnace to minimise the difference between maximum metal temperature and gas temperature.

Thermal Cycles

Given the unit system and the possibility of large unit ratings, new prospects for the development of the thermal cycle and higher thermal efficiencies were opened. A major effect of dispensing with any interconnection between turbines and boilers on a range system has been the almost universal application of the reheat cycle which, at the pressures being used at the present day, increases the thermal efficiency of the plant by between 4 and 5 per cent.

The 30 and 60 MW sets installed in large numbers immediately after the war were designed to utilise existing materials as far as possible. However, at the same time a number of experimental 60 MW units with turbine stop valve conditions of 1,500 p.s.i., 1,050°F were ordered to promote development. Table 1 shows in respect of one typical component, the steam piping, how the development of new materials was encouraged by this step. Later, some machines for the same steam conditions, but rated at 100 MW, were installed, and since the practicability of the large unit boiler and the unit system had by this time been established, it was decided to re-introduce the reheat cycle. The first units were aimed only at equalling the efficiency of the 100 MW units at 1,500 p.s.i., 1,050°F, and were therefore designed for 1,500 p.s.i., 975°F, reheating to 950°F. Once the principles of design of reheat plant had been established, a large number of 120 MW reheat units were ordered. This represented virtually the most economical plant, given a generator with conventional hydrogen cooling, and with materials limited to the low alloy ferritic steels apart from possibly a very small amount of austenitic steel in the later passes of the superheater tubes.

TABLE 1.—STEAM CONDITIONS AND STEAM PIPE MATERIALS FOR VARIOUS UNITS

Unit rating	Steam conditions at T.S.V.		Year	Steam Pipe Material
	lb/sq in gauge	°F		
30 MW	600	850		Mild steel
60 MW	900	900		1 per cent Cr, ½ per cent Mo
60 MW	1,500	1,050		2¼ per cent Cr, 1 per cent Mo Austenitic
100 MW	1,500	1,050	1955	Austenitic Cr-Mo-Va
100 MW reheat	1,500 445	975 955	1956	2¼ per cent Cr, 1 per cent Mo 1 per cent Cr, ½ per cent Mo
120 MW reheat	1,500 360	1,000 1,000	1957	2¼ per cent Cr, 1 per cent Mo Cr-Mo-Va 1¼ per cent Cr, 1 per cent Mo
200 MW reheat	2,350 425	1,050 1,000	1959	Cr-Mo-Va 2¼ per cent Cr, 1 per cent Mo 1¼ per cent Cr, 1 per cent Mo 1 per cent Cr, ½ per cent Mo
275 MW reheat	2,300 550	1,050 1,050	1962	Cr-Mo-Va 2¼ per cent Cr, 1 per cent Mo
550 MW reheat	2,300 550	1,050 1,050	1963	Cr-Mo-Va 2¼ per cent Cr, 1 per cent Mo

The use of 1¼ per cent Cr, 1 per cent Mo and 1 per cent Cr, ½ per cent Mo on the 120 MW and 200 MW units is confined to the hot reheat piping.

When the 200 MW directly-cooled generator came to be applied, a further step in temperature and pressure could be envisaged. It was expected that a considerable increase in pressure would be economical, but there was no disposition to enter the as yet hardly explored supercritical region. It was therefore decided to limit the turbine pressure to 2,300 p.s.i. and the boiler drum pressure to 2,650 p.s.i. with a maximum safety valve loading of 2,750 p.s.i. at which pressures reliable natural circulation could still be assured. Certain boiler makers preferred to assist the natural circulation by pumping at this pressure in spite of the loss of about 0·15 per cent in extra auxiliary power, and both types of boiler are currently being applied.

The cautious approach to critical pressure and austenitic materials has been reflected in the adherence to the same basic temperature and pressure for all units of 200 MW and over, although the reheat temperature has been raised to 1,050°F in all units over 200 MW. As a development project, however, two units for steam conditions of 3,500 p.s.i., 1,100°F at the turbine stop valve with reheat to 1,050°F have been ordered. In these two plants a definite step into the use of austenitic materials for superheater tubes, headers, steam piping and turbine steam chests and nozzle boxes has been made, whereas on the 2,300 p.s.i., 1,050°F units the use of austenitic steels could still be confined to certain superheater and reheater tubes.

Needless to say, a regenerative cycle is used in all central power station plant. Broadly speaking, the final feed temperature and the number of feed heating stages are determined by economic considerations. The thermal design of the feed heating system has, however, become more complex as the temperature and pressure have advanced. Desuperheating and sub-cooling zones are provided in the surface heaters and in the largest units, i.e. those of 300 MW and over, the boiler feed pump driving turbine has been integrated into the feed heating system. This arrangement has the advantage that the steam supply to the feed heaters has not been reheated (see Fig. 3), and the degradation of heat in the feed heaters is therefore less than if steam had been bled from the main turbine.

The disposition of the feed water temperature rise amongst the successive heaters in the train varies according to the cycle, whether non-reheat or reheat, and according to the source of heating steam. In each case a careful analysis is necessary to find the most economical arrangement. Factors entering into such an analysis include not only the thermal performance and the cost of the feed heating plant, but also the factors dependent on reheat pressure such as the cost of the reheater, piping and valves and the efficiency of the first stage of the reheat turbine, since a distinct break occurs in any curve of costs and operating conditions against feed water temperature at the point where bled steam is taken from before rather than after the reheater. In practice, the final feed water heaters in all plants being installed by the Generating Board are supplied with steam from the cold pipe to the reheater, but there is no fundamental reason why a tapping should not be taken from the high-pressure cylinder as well, if it should ever prove economical to do so.

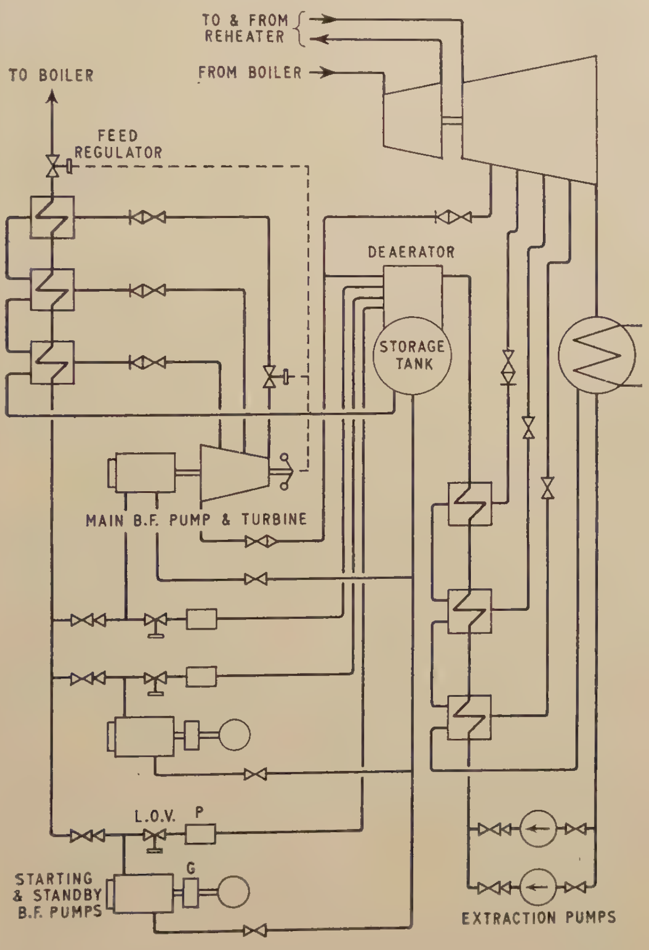


Fig. 3.—Diagrammatic arrangement of boiler feed system with turbine-driven pump

G — Gearbox. LOV — Leak-off valve. P — Pressure reducing chamber

TABLE 2.—TYPICAL POWER STATION THERMAL EFFICIENCIES

Turbo-generator rating, MW	60	120	200	350	500	375
Pressure at turbine stop valves, lb/sq in gauge	900	1,500	2,350	2,300	2,300	3,500
Temperature at turbine inlets, °F	900	1,000/ 1,000	1,050/ 1,000	1,050/ 1,050	1,050/ 1,050	1,100/ 1,050
Vacuum at turbine c.m.r., in Hg ...	28·9	28·9	28·9	28·9	28·7	28·7
Feed temperature at last heater, °F ...	385	435	460	485	485	505
STATION EFFICIENCIES						
(i) Optimum or design, per cent	30·5	35·6	37·5	39·1	39·2	39·9
(ii) New plant base load, per cent ...	29	34	35½	37	37½	38
(iii) Average lifetime, per cent	28	33	34½	35½	36	36½

The figures are given for typical stations with the load factors and vacuum appropriate to each, and are not strictly comparable in all respects. Lines (ii) and (iii) are rounded off to the nearest half digit.

Thermal Efficiency

The thermal efficiencies realised by plant designed in accordance with the foregoing are set out in Table 2. It will be appreciated that the figures for the largest units are as yet predictions only. This table includes the allowances to be made for station auxiliaries and for the losses due to day-to-day service at varying loads and in intermittent operation.

Materials

No particular comment is called for on the materials to be used within the ranges of temperature and stress in which various combinations of mild steel, cast iron and cast carbon steel can be employed, apart from the observation that in structures like turbine l.p. cylinders, exhaust casings and condensers there is a strong trend towards the use of mild steel fabrications. Above 850°F the demand for creep strength can be met by low alloy steels within the Cr-Mo-Va class, or in the 12 per cent Cr class, where freedom from corrosion is important.

For the supercritical units with steam temperatures exceeding the limits to which ferritic steels can be economically applied, an austenitic steel of the 18 per cent chromium, 13 per cent nickel, 2½ per cent Mo composition is most likely to be used with some 18 per cent Cr, 12 per cent Ni, 1 per cent Nb for superheater tubes. Experience of the 60 and 100 MW units at 1,050°F has shown that serious difficulties can arise in the welding of thick sections of austenitic steel, but it is believed that with the composition now selected, and with weld metals selected with an eye to ductility, and with careful control of stress relief, thoroughly reliable welds can now be produced. It has also been established that satisfactory transition pieces between the austenitic piping and the ferritic turbine casings can be produced by welding. No difficulty has been experienced in the straightforward butt welding of austenitic and ferritic superheater tubes of thin section. All the site welds are, of course, between like materials.

It is difficult and certainly costly to produce large forgings for a single piece low-pressure rotor with complete soundness and homogeneity throughout the mass and particularly at the central bore and with adequate notch toughness, although such rotors have the advantage of being more lightly stressed for a given size of blading than the built-up type. The shrunk-on discs for built-up l.p. shafts are heat treated to a 0·2 per cent proof strength of the order of 50-55 tons/sq in for the largest sizes, and to some reasonable degree of notch toughness. The alloys used for blading obviously require high strength, but high ductility and notch toughness cannot be sacrificed. Hard shields of stellite or some similar material are applied to the leading edges of the last few stages for protection against erosion by water drops.

On the boilers, increasing use is made of the higher tensile carbon steels for tubes and 36-38 tons/sq in alloyed steel for boiler drums. A 32-34 tons/sq in alloyed steel is used for some headers. The ferritic steels 1 per cent Cr/½ per cent Mo, and 2 per cent Cr/1 per cent Mo are used up to 1,080°F metal temperature for the latter, and then the austenitic steels previously mentioned. Half per cent Mo steel is not now used owing to serious cracking troubles on steam pipes, superheater tubes and headers and 1 per cent Cr/½ per cent Mo is substituted.

Boiler Details

Coal Firing.—One of the major problems with the larger unit lies in the large amount of coal which is injected to the furnace. The 500 MW unit, for example, will be using nearly 200 tons of coal per hour, and this needs to be mixed with nearly ten times its weight of hot air. It is necessary to keep down the excess air on the grounds both of reducing stack losses and of increasing the available temperature in the furnace for heat transfer, and there is the problem of intimately mixing this great mass of coal and air satisfactorily. It is difficult to sub-divide the primary air/coal flow accurately between the burners, so as to give exact proportioning of air to coal at each burner. Unless this is achieved satisfactorily there is a danger of temperature peaks across the width of the furnace and also of local reducing conditions. The latter is especially dangerous as it can lead to rapid tube wastage both on water-cooled and on steam-cooled tubes. The larger boilers have, of course, necessitated the use of multiple furnaces. This is particularly the case with corner firing, as front and opposed firing units can be built with a single furnace.

Oil Firing.—Most of the Board's oil-fired boilers have been converted from existing coal-fired units; because of this, the oil-firing installation is often not as efficient as one in a boiler designed especially for oil burning. The oil used has a calorific value of 18,275 B.Th.U./lb and a viscosity up to 6,000 sec Redwood, at 100°F. The experience of the Central Electricity Generating Board over the past few years has shown that it is possible to burn oil satisfactorily in these relatively large units, but it has emphasised the imperative necessity for the absolute minimum of excess air, i.e. corresponding to less than 1 per cent oxygen in the flue gas, if SO_3 formation is to be avoided and thereby prevent corrosion in the air heaters and flues.

Most of the oil-fired boilers are 60 MW units burning 17 tons of oil per hour, with a steam output of 550,000 lb/hr; there are also three 120 MW units. It was realised that there would be a limited amount of coke formation; calculations showed that this amount in total on our large installations might constitute a nuisance and therefore the grit catchers and electrostatic precipitators were retained in service. Experience has shown the value of this decision.

Casings.—It has proved most economic to design the boilers to be of the suspended type, that is to say, the drums and furnaces, etc., are suspended either from the building steel work or from a special steel frame. Expansion is wholly downwards, and this can amount to as much as 12in. Difficulties have been experienced in keeping the casings tight, and as it is now known that in addition to the nuisance of dust escaping, casing leakages have an important influence on the efficiency of the unit, special attention has been given to this, and boilers are now designed with a fully welded case.

Where the furnace is water cooled, this casing is welded directly on to the water tubes and backed by insulation and a further protective casing. Where steam-cooled walls are envisaged there has to be some relative movement between the various tubes and the casing, and in this case the steam tubes are often allowed to slide within a fixed casing.

Air Heaters.—All the Board's boilers are fitted with air heaters. For a time the designed gas exit temperature was 280°F for coal, but following satisfactory experience this has gradually been reduced to 250°F, except in low-load factor units where it will be increased to 260°F on economic grounds.

For the larger units regenerative type air heaters are in use, mainly because of space considerations. There is a limit to the practicable size of these and up to four can be used on any one boiler.

It has been possible to design these air heaters up to the present on the basis of the air temperature required for the drying air for the coal mill, but in certain cases separate air heaters are now fitted for the mill drying air and the main air heaters can be designed on economic grounds in conjunction with the economiser surface. Feed inlet temperatures are now reaching over 500°F, so that it can be imagined that there are limitations in the amount of economiser surface which can be used economically.

Fans.—High-efficiency fans having a static efficiency of about 85 per cent are always used and the analysis of innumerable tenders has shown that the most economic arrangement for C.E.G.B. conditions is to have single-speed forced draught fans, and two-speed induced draught fans, with the normal operating point of the induced draught fan just below the changed speed point. Both fans have squirrel cage motors with vane control.

The choice of fan drive is related to the requirement that the boiler will always be operating at or near its full-load capacity, and the design has the great advantage of simplicity and robustness. Commutator motors have been used for variable-speed fans with reasonable success, but the high capital cost of these motors makes their use uneconomic.

The largest fans so far ordered are for 46,500 cu ft/min at 90°F and 14in w.g. for forced draught and 800,000 cu ft/min at 245°F and 16in w.g. for induced draught.

Originally, either three or four pairs of fans were required for the larger units, but with the above sizes recently developed, two sets can be used.

Turbine Details

General Construction.—In this country a speed of 3,000 r.p.m. is nearly always preferred for reasons of cost, in spite of a slightly lower internal efficiency, but a particular combination of unit rating, steam conditions and exhaust pressure can prove favourable to a four-pole speed. Sometimes these conditions justify the use of a cross-compound turbine, particularly where it is possible to adopt a total unit rating greatly in excess of the maximum output available from a single generator. In any other case, the cross-compound set is bound to be more expensive than one with a single generator, and can be justified only as a means of handling exceptionally large volumes of steam efficiently.

Both impulse and reaction types of turbine are used, although the nominal distinction between the two increasingly tends to reflect differences in the application of traditional styles of design, rather than intrinsic thermodynamic differences. The amount of reaction developed towards the tip of a stage of the proportions used in large power station turbines, even with zero reaction at the root, is quite considerable.

The critical components of these turbines, i.e. those involving the heaviest development costs, tend to be applied by the manufacturers to a range of machines by way of combinations and arrangements which provide an economical machine at the specified rating and other specified conditions. A case in point is the last stage in which the stressing problems and the aerodynamic problems are at their most severe.

Casings.—The design of the turbine casings is governed largely by the high pressures and temperatures obtaining at the steam inlet end, and by the very large volumes of steam to be contained at the exhaust end. With the materials available for casings and bolts a double-shell construction is necessary for the h.p. cylinder and possibly the i.p. cylinder inlet of any machine handling steam at 2,300 p.s.i., 1,050°F with reheat. The 1,500 p.s.i., 1,000°F machines occupy a borderline position in which the single casing design is practicable but could impose limitations on rates of heating and cooling. The casings are designed to minimise the thermal stresses during changes of load, and are therefore, as far as possible, simple and symmetrical in shape with a complete arc of admission to maintain thermal symmetry. The horizontal joint flanges, bolts and other heavy components are provided with steam passages where appropriate to control their temperature and rates of heating and cooling. All bolt tightening in the high-pressure region is, of course, done under heat. The casings and the bearing pedestals are all anchored and guided in such a way as to permit free expansion without loss of alignment, and the connections between the turbine casing, the steam chests and the main steam pipes are arranged to provide all the necessary flexibility. The valve chests are not cast in one piece with the turbine cylinders, although in certain designs the throttle valves and the reheat intercept valves are mounted directly on the turbine casing as a means of minimising the volume of steam stored in the piping beyond control of these valves.

Shafts.—In a number of machines up to 100 MW rating, flexible couplings are used between cylinders and in the more refined versions these are reasonably satisfactory. Many machines below 100 MW and all above have solid couplings, and hence a single thrust bearing which, in the reheat sets, is invariably placed between the h.p. and the i.p. cylinders. Differential expansions between the casings and rotors are therefore held to a few thousandths of an inch at the points where fine clearances have a material effect on turbine performance, but may accumulate to something of the order of ½in at the generator end of a multiple flow l.p. turbine. The single span natural frequencies of such a shaft cannot adequately describe its behaviour when coupled in this manner, but in general it is preferred to have no large amplification factor to deflections of the h.p. and i.p. rotors below running speed. There are, however, examples of successful machines running with all spans of the rotors participating in the array of critical speeds below running speed. The shafts have to withstand not only the full-load torque, but also the short-circuit torque, which is several times as great, and being of a harmonic character requires the shaft to be designed to avoid resonance in the torsional mode as well as transversely. Labyrinth glands are invariably used on large machines. The steam and water sealing systems are automatically controlled.

Bearings and Lubrication.—Journal bearings are used throughout the turbo-generator. Considerable research is in hand aimed at reducing the heavy losses normally occurring in bearings of the large size demanded by the torque to be transmitted. Thrust bearings are of the Michell type, in which the current development efforts are aimed largely at equalising the loads on the individual pivoted pads.

Centrifugal oil pumps are used with sets over 100 MW, while in smaller sizes gear type pumps have proved generally satisfactory. In addition to the shaft-driven oil pump the set is provided with an a.c. motor-driven auxiliary oil pump with sufficient capacity to provide control oil and lubricating oil as well; an a.c. motor-driven lubricating oil pump for use when the set is on the barring gear during a shut-down; and a d.c. motor-driven lubricating oil pump for use in emergencies when the a.c. auxiliaries may be lost. A.c. and d.c. hydrogen seal oil pumps are also provided.

Control Gear.—The control gear is normally of the oil-operated type, although in some designs a fire-resisting fluid is used in a circuit quite separate from the lubricating system. The control gear has to perform a number of separate functions as follows:—(a) Control of frequency when operating independently of an electrical grid; (b) load control when operating synchronously in parallel with an electrical grid; (c) control of transient speed during load changes so as to avoid danger; and (d) control of the machine when failure of some element of the governing gear occurs.

These requirements are normally met by a combination of a centrifugal governor controlling the main throttle valves and reheat interceptor valves, and an unbalanced centrifugal type of emergency trip device designed to shut the main steam and reheat steam emergency valves. The regulation of the governor from no load to full load is specified as not exceeding 4 per cent of the rated speed, and the set point may be adjusted for synchronising and

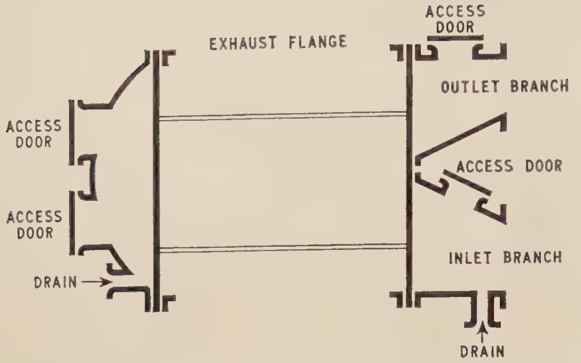


Fig. 4.—Schematic arrangement of condenser water boxes, shown as for a two-pass condenser

load changing from 6 per cent below rated speed at no load to 2 per cent above the rated speed at full load. The speed governor is designed so that on complete rejection of rated load, the temporary speed rise will not be so high as to trip the emergency governor which is set at 10 per cent above rated speed. This represents a formidable requirement for any control gear, since the turbine acceleration on loss of full load is of the order of 10-15 per cent per second.

The large storage capacity of the reheater is such that a performance of this order could not be ensured without a duplication of the control valves at the inlet to the i.p. turbine. The emergency trip gear is designed to be, as far as possible, separate from the speed regulating system, and to operate on a different principle, so that the possibility of coincidental failure of the speed regulating system and of the emergency tripping system is as remote as possible. Again, these considerations apply to the reheat steam inlet as well as the main steam inlet.

A great deal of research has been and is being devoted to finding materials that will neither seize nor corrode at temperatures over 1,000°F and to elucidate the behaviour of steam in the valve and chest passages so as to control the aerodynamic forces and prevent vibration or fretting of the stems and bushes. Provision is made for the testing of the valves and relays while the turbine is on load. Devices are also included for reducing load and eventually tripping the machine out on loss of either main steam pressure or vacuum.

Supervisory Gear.—The operator is provided with a range of instruments designed to give the information necessary for safe and efficient operation of the plant. In particular, the turbine is fitted with supervisory gear showing the output, the speed, the eccentricities of the various rotors, the vibration of the rotors or bearing pedestals, the expansion of the rotors relative to the casings, the absolute expansions of the pedestals on the foundation, and temperature gradients through the high-temperature casing metal or some relationship between steam and metal temperatures which determines this gradient. It is by the use of this gear that the monitoring of starting behaviour and any abnormal running is carried out.

Condensers.—The turbine exhaust proportions, the condenser surface and the circulating water quantity and velocity are determined primarily by economic considerations, as is the cooling water temperature where a re-circulating system is employed. The surfaces actually used in British conditions have averaged about 0·8 sq ft/kW for the smaller units with low steam conditions and 0·6 sq ft/kW for the more advanced. Copper alloy tubes appropriate to the circulating water conditions are used. They are rolled into the tube plate at one end, and either rolled in at the other or sealed with some form of metallic packing. In the larger sets, double-tube plates are being provided so as to avoid the need for conditioning the boiler water against minor leakages. A feature which is now being more and more widely adopted is the integration of the condenser and turbine structures. The condenser is supported on springs and solidly bolted or welded to the l.p. turbine.

Fig. 4 shows schematically the form of water head that is increasingly being adopted. This dispenses with the traditional hinged water box door, and provides an entry of very low hydraulic loss. The circulating water pumps are usually of the horizontal centrifugal type, but on appropriate sites mixed flow and axial flow vertical pumps may be used. In this country the circulating water pumps are almost invariably bussed on their discharge side for security, but elsewhere, especially in association with axial flow pumps, a valveless unit system is commonly adopted. Steam jet air ejectors are usually employed with steam at low and moderate pressures, but in nearly all units with steam pressures of 1,500 p.s.i. and higher, water-operated air pumps are used.

Feed Water System.—Up to eight stages of feed water heating are employed in modern stations. A de-aerator forms one of them, and in this country is normally at a pressure of 2 or 3 atmospheres. Surface heaters are normally used for all other stages. The boiler feed pump may be placed either before or after the heaters following the de-aerator, according to the relative costs of the two arrangements. As mentioned earlier, units of 300 MW and more have turbine-driven pumps as in Fig. 3. The change-over stems essentially from the rapid fall in cost and rise in efficiency of the small turbine in the range of powers concerned here, i.e. over 5,000 h.p. The motor-driven feed pumps are normally driven at two-pole motor speed, i.e. 3,000 r.p.m., but the turbine-driven pumps are free of any such restriction, and are usually designed for considerably higher speeds. Non-ferrous feed heater tube materials have been used traditionally, but in almost all British stations commissioned from 1961 onwards, mild steel tubes welded into the headers will be used. This development has permitted a considerable reduction in the cost of very large heaters for full boiler pressure, but it is nonetheless still economical to arrange the high-pressure heaters in two or more lines in parallel.

MODERN ROLLING MILL PRACTICE

THE Institution of Plant Engineers has arranged to sponsor a symposium on modern rolling mill practice which will take place at the University, St. George's Square, Sheffield, on Wednesday, 11th April, 1962. The programme will include the following papers: " Developments in the Design of Rolling Mills," by R. B. Sims, Ph.D., B.Sc., M.I.Mech.E., and P. A. Clark (Davy & United Engineering Co., Ltd.); " Modern Control Techniques for Rolling Mills," by P. E. Peck, B.Sc., A.M.I.E.E. (Heavy Plant Division, Associated Electrical Industries, Ltd.); and " Modern Techniques for Servicing Rolling Mills," by R. N. Dale, A.M.I.Mech.E. (chief new work engineer, Steel Company of Wales, Ltd.).

AN OSCILLATING SYNCHRONOUS LINEAR MACHINE

By **E. R. LAITHWAITE,** M.Sc., Ph.D., A.M.I.E.E., and
R. S. MAMAK, B.Sc., Graduate I.E.E.

Summary by the authors of a paper entitled "An Oscillating Synchronous Linear Machine," which was read at a meeting of the Utilisation Section of the Institution of Electrical Engineers in London yesterday (Thursday)

ROTARY motion is generally more convenient than linear motion in both mechanical and electrical machinery and consequently is more economical. Nevertheless, many processes in industry require linear motion, generally reciprocating. Electrical machines which involve mechanical movement are nearly all rotary, but when used to generate power are often driven by prime movers which are basically reciprocating devices, the necessary conversion from linear to rotary motion being achieved mechanically at considerable expense. When used as motors, electrical machines are often called upon to drive pumps or other reciprocating machines where similar conversion is necessary.

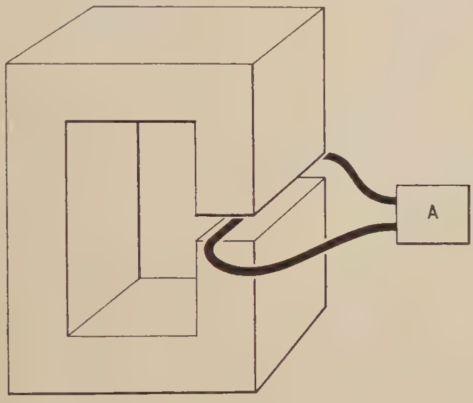


Fig. 1.—Primitive form of moving-conductor generator

It was decided to investigate the possibilities of a direct electrical oscillating drive, perhaps the simplest form of which is shown in Fig. 1. If the conductor is oscillated mechanically between the poles of the permanent magnet, a.c. will be generated in the load A. If, on the other hand, A is a source of a.c., the conductor will be vibrated between the poles and be capable of providing mechanical output.

This simple construction is impracticable because a very large current would be required in a single conductor to generate any appreciable force. This would mean that the conductor had to be very thick and yet remain flexible, which is difficult to achieve. If, however, the magnet system be duplicated, so that the conductors form a loop, this loop can be made to embrace a second magnetic circuit also, thus constituting a single-turn winding of a transformer. This winding could then be reciprocated whilst the other winding remained fixed. Fig. 2 shows a schematic layout of such a system. The permanent magnets in this machine are replaced by electromagnets so that the machine has exciting windings of the same nature as those in the rotating synchronous machine.

The disadvantage of this machine is that the single-turn winding, being much larger than the central limb of the transformer to allow room for it to move, will have a very high leakage reactance, in fact in terms of conventional machines the synchronous part of the machine is good, but the transformer is very poor.

The final stage in the development consists of turning the motion through 90° so that the loop is closely coupled to the fixed winding and is able to move by sliding along the limb. The general layout of this machine is shown in Fig. 3. The section of iron used in the transformer must be great enough to contain both the a.c. and d.c. fluxes, but the d.c. poles are required to carry only the d.c. flux. Incremental permeability is obtained in the a.c. magnetic circuit. Leakage reactance of the oscillating loop is likely to be high unless steps are taken to limit it. The d.c. poles should be covered with conducting sheets, and the centre limb of the transformer can be similarly treated, except that the sheets must not be joined at the edges, lest they form a closed loop around the limb.

One of the advantages of this type of machine is that the conductor, which is associated with the air gap, is a single turn which requires no insulation and can therefore be run very hot. The other transformer winding, being remote from the air gap, can be more easily cooled than windings in slots, such as are found in rotating

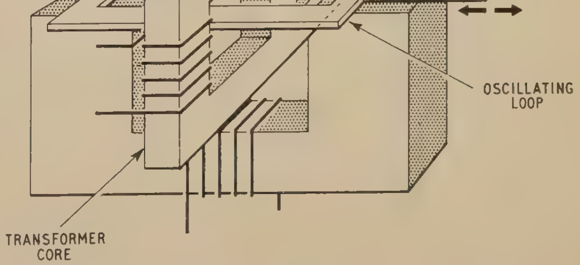


Fig. 2.—First stage development of linear machine

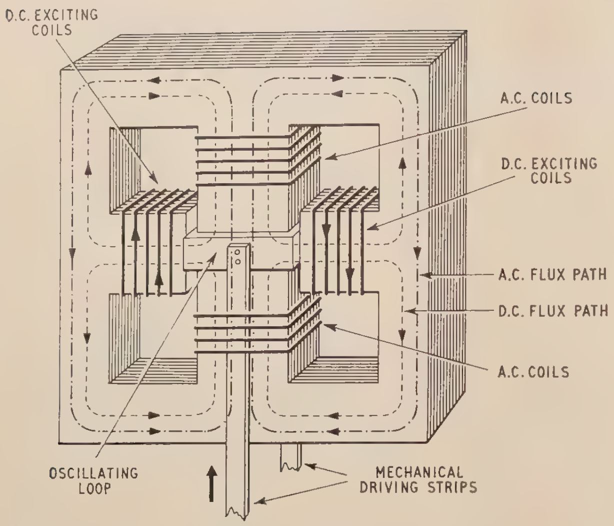
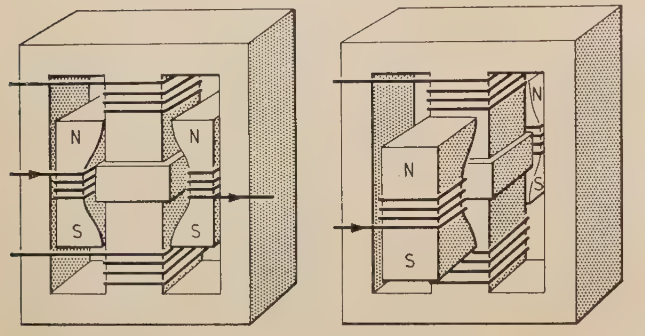


Fig. 3.—Final form of reciprocating generator



(a) CO-PLANAR CONSTRUCTION (b) CRUCIFORM CONSTRUCTION

Fig. 4.—Four-pole forms of machines

machines. This enables the power/weight ratio in the oscillating machine to be made reasonably high, for there is no doubt that the oscillating machine cannot compete mechanically with the surface speeds of conductors in rotating machines. The output of a rotating machine is proportional to d^2ln where d is the diameter, l the length and n the speed in r.pm. In terms of surface speed v, this may be written dlv, and the comparable formulæ for the oscillating machine are $a^2l\omega$ or alv so that the amplitude " a " of oscillation corresponds to the rotor diameter in the conventional machine.

The other properties of the oscillator are similar to those of a rotary machine, for example, it can be allocated a synchronous impedance, can be over-excited to take leading current, etc., but there are certain notable differences.

First, the machine will take leading current when running light, purely on account of the inertia of the loop. Second, when run as a motor it will self-start. Third, as a free-running motor a large amount of copper loss will be produced since current is put into the loop to accelerate it, whilst further current is required to stop it. In view of this last effect, the machine can be considerably improved by connecing the oscillating loop to a pair of mechanical springs and tuned mechanically to the supply frequency. The input current is then only required to make good the mechanical losses in the system.

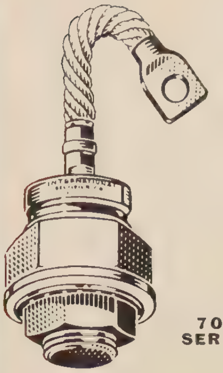
Comparison of Four-pole Machines

One other comparison between the rotary and linear machines produces an interesting result. In rotary machines, the motors may have 2, 4, 6, 8, 10, etc., poles, a four-pole machine running at half the speed of a two-pole, and so on. The four-pole equivalent oscillating machine is shown in Fig. 4. The d.c. poles can now no longer be flat-faced but must be shaped to give the necessary sinusoidal e.m.f. Examination of Fig. 4 shows that, for example, when the machine is used as a generator, two complete cycles of e.m.f. are produced for one cycle of mechanical movement. Moreover, the magnetic circuitry is improved also in that only the centre limb is called upon to carry both a.c. and d.c. fluxes. The d.c. poles may be brought out on to the front and back faces as in Fig. 4 (b) with advantage, since such an arrangement discourages a.c. leakage flux even without copper screens. There is no reason why all four faces of the centre limb should not carry d.c. poles. Present investigations are concerned with the testing of the oscillating machine as a reciprocating pump drive.

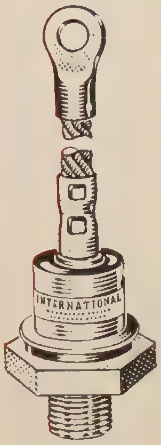
Electromagnetic Screening

MODERN radio-frequency techniques have made necessary the increasing use of screened enclosures. Any one such enclosure has to provide the required attenuation within a wide frequency band. Those in common use vary from small cans fitted over a single component to large hangars. Report Ref. M/T135, recently published by the Electrical Research Association, presents a unified theory of screening, expressed in terms easily understandable to engineers who may have to design or use screened enclosures. In the quantitative analysis it has been assumed that approximate but simple formulæ are potentially much more useful than more exact but cumbersome calculations. The theoretical approach is general and applicable to all the basic types of conducting screens, but detailed considerations are restricted to the most difficult, and least adequately covered, case of large enclosures. Mechanical design is omitted except for a few notes on those aspects of it which have an inherent effect on the electrical performance. Adequate bonding and filtering is assumed in the treatment, so that the performance, as calculated from the formulæ, represents the limit which can, and in many cases should, be attained with good construction and under proper operating conditions. The effects of constructional faults are discussed in the companion report, Ref. M/T132, entitled " Testing of Screened Enclosures." The full report, entitled " Electromagnetic Screening—Theory and Practice," by J. Miedzinski, Ref. M/T135, is obtainable from the Electrical Research Association, Cleeve Road, Leatherhead, Surrey, price 36s, postage 1s.

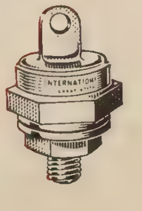
Code	Rated P.I.V.* Volts	Maximum Rectified§ Forward Current		Max. Peak Surge Current (sinusoidal) 10mS at Working Temp. Amps.	Typical Forward Volt Drop over Conducting Period Volts.
70U SERIES 70 TO 250 AMP.		Convection Cooled Amps.	Fan Cooled at 1000 L.F.M. Amps.		
70U5	50	110	220	2000	1.05
70U10	100	110	220	2000	1.05
70U20	200	110	220	2000	1.05
70U40	400	110	220	2000	1.05
70U60	600	110	220	2000	1.05
70U80	800	110	220	2000	1.05
45L SERIES 45 TO 150 AMP.	RATING NOTES: *Maximum peak voltage which must cater for peak of crest plus any transients in the system §Single phase halfwave rating, mounted on 7" x 7" by 0.160" thick fin, at 30°C Ambient				
45L5	50	58	130	1500	1.05
45L10	100	58	130	1500	1.05
45L20	200	58	130	1500	1.05
45L40	400	58	130	1500	1.05
45L60	600	58	130	1500	1.05
45L80	800	58	130	1500	1.05
45L100	1000	58	130	1500	1.05
25H SERIES 25 TO 45 AMP.	RATING NOTES: *Maximum peak voltage which must cater for peak of crest plus any transients in the system §Single phase halfwave rating, mounted on 5" x 5" by 0.1" thick fin, at 30°C Ambient				
25H5	50	20	55	400	1.05
25H10	100	20	55	400	1.05
25H20	200	20	55	400	1.05
25H40	400	20	55	400	1.05
25H60	600	20	55	400	1.05
	RATING NOTES: *Maximum peak voltage which must cater for peak of crest plus any transients in the system §Single phase halfwave rating, mounted on 3" x 3" by 1/16" thick fin, at 30°C Ambient				



70U SERIES



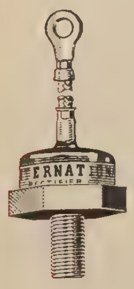
45L SERIES



25H SERIES

HIGH POWER 25 to 250 amps

Code	Rated P.I.V.* Volts	Maximum Rectified§ Forward Current		Max. Peak Surge Current (sinusoidal) 10mS at Working Temp. Amps.	Typical Forward Volt Drop over Conducting Period Volts.
25HB SERIES 25 TO 35 AMP.		Convection Cooled Amps.	Fan cooled at 1000 L.F.M. Amps.		
25HB5	50	20	53	300	1.05
25HB10	100	20	53	300	1.05
25HB20	200	20	53	300	1.05
25HB40	400	20	53	300	1.05
25HB60	600	20	53	300	1.05
25HB80	800	20	53	300	1.05
	RATING NOTES: *Maximum peak voltage which must cater for peak of crest plus any transients in the system §Single phase halfwave rating mounted on 3" x 3" by 1/16" thick fin, at 30°C Ambient				



25HB SERIES

SILICON DIODES

INTERNATIONAL RECTIFIER COMPANY

(GREAT BRITAIN) LIMITED · OXTED · SURREY · Oxted 3215

Associate company of International Rectifier Corporation U.S.A.
and the Metal Industries Group, Great Britain.

'ENGLISH ELECTRIC'

H.R.C. CARTRIDGE FUSE-LINKS

INDUSTRY

ELECTRICITY SUPPLY

DOMESTIC CONSUMERS' UNITS

PLUGS

TRACTION

RAILWAY SIGNALLING

AIRCRAFT

ADMIRALTY & INTERSERVICE

SEMI-CONDUCTOR RECTIFIER PROTECTION

THE STANDARD OF QUALITY AND PERFORMANCE THE WORLD OVER

FUSEGEAR DIVISION, EAST LANCASHIRE ROAD, LIVERPOOL, 10
The English Electric Company Limited, English Electric House, Strand, London, W.C.2.

FG 64

VIEWS on the NEWS

By "REFLECTOR"

LANDOWNERS with property within a five-mile radius of the Bradwell nuclear power station are protesting against the blocking of development in the area and what they regard as inadequate compensation for the loss of their rights. This compensation is based on the existing use value not on its development value. It is claimed by the landowners that the area has distinct possibilities as a week-end resort: one protester is reported by *The Times* to have said that "the magnificent road which the C.E.G.B. built from Latchingdon to Bradwell when the power station was being erected encourages people to come to this beautiful, quiet corner of Essex." It is amusing to recall that when the station was projected there was an outcry against the spoliation of the area. Now, it seems, the C.E.G.B. has become the instrument for protecting it against such a fate.

* * *

A.M.E.E. News (the bulletin of the Association of Managerial Electrical Executive) for November/December had to go to press while the threat of a stoppage of electricity supply was still in the air and its editorial was couched in appropriate terms. It was possible, however, to squeeze in a little " stop press " note saying: " Reason has prevailed." In view of the nature of the settlement and the subsequent uproar this was a nice way of putting it.

* * *

I have received a copy of an illustrated brochure produced to mark 25 years of operation of the Fulham power station. It relates, of course, to the present station; Fulham actually began a supply in 1901. This 32-page publication is rather elaborate and contains separate coloured plates of the site plan and a vertical cross-section of the station. I am left wondering whether Fulham was especially chosen for treatment or whether it is proposed to deal with numerous other power stations in the same way—which would be quite an expensive business.

* * *

A New Zealand newspaper, commenting on the New Zealand Government's decision to stop work on the Maraetai No. 2 power station, on which £3 million has already been spent, says (ironically, I hope) that this will mean a saving of £2 million because the station was expected to cost over £5 million. We have had examples of such " savings " in this country from time to time, but generally they result from deferment, not abandonment. I may instance the slowing-down of railway electrification and the spreading-out of the nuclear power programme. By these means expenditure in a particular year is reduced but the ultimate result is a much greater cost.

* * *

In a recent note I reported that American electrical utilities were being asked to participate in the provision of a national emergency alarm repeater system. Under this scheme devices to give warning of impending attack would be installed in homes and operated by the utilities. Now, it seems, there are doubts whether electricity consumers would want to pay for these devices and the utilities are being asked to provide them at their own expense. They, too, seem generally reluctant to do this unless they receive a Federal subsidy and that would necessitate special legislation. The old-fashioned siren would be cheaper and less troublesome I should imagine.

* * *

Complaints were made at a meeting of the Plymstock Parish Council (Devon) about the amount of smoke emitted from the Prince Rock power station. One member said:—

> " I was at Bovisand the other day when a great ball of smoke rolled down the hill and then went on out to sea. It looks very pretty and has pearly shades in it, but really I think it is dangerous to health."

This pretty puff cannot have done much harm except perhaps to passing shipping.

* * *

The *Electrical Review* of 6th December, 1901, reported the address of Mr. C. H. Wordingham as chairman of the Manchester Section of the Institution of Electrical Engineers. In the course of this, Mr. Wordingham expressed the view that the steam engines then used in power stations (the turbine had not yet " arrived ") would be supplanted by producer-gas engines. He went on to suggest that

> " gas engineers who are not wilfully blind to events must recognise that the public likes electric light and power if it can get them at a reasonable cost. It would be far wiser for them to accept the inevitable, and by joining hands with those they now look upon as enemies participate in this new outlet for their enterprise. Electrical engineers on their part would do well to recognise that gas engineers can help them, and to invoke their assistance in the application of gas for the production of electrical energy."

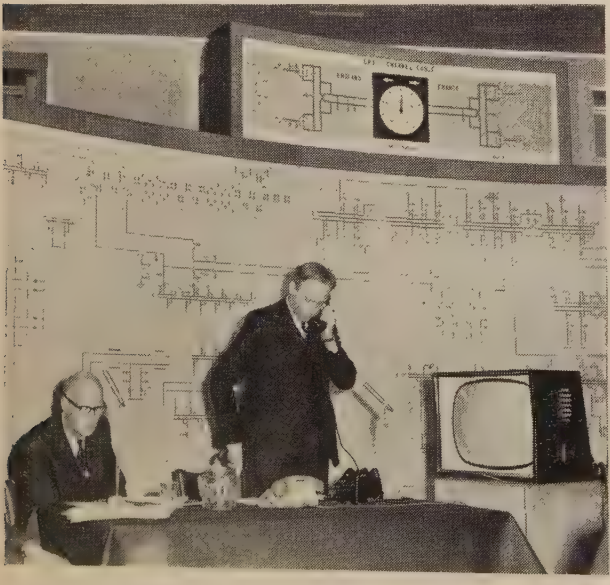
Cross-Channel Cable

On Friday last the cross-Channel power cable linking the British and French power systems was officially inaugurated and it is now operating on a commercial basis. A description of the project appeared in last week's issue

THE inauguration of the cross-Channel power link was carried out simultaneously in both Britain and France using a television and sound link which had been arranged with the co-operation of the B.B.C. and Radio Television Française. The opening consisted of ceremonies on both sides of the Channel; at the East Grinstead grid control centre, Sussex, by Mr. Richard Wood, Minister of Power, and at Plessis Gassot switching station, Paris, by M. Jeanneney, the French Minister of Industry and Commerce.

At East Grinstead the Minister of Power was welcomed by Sir Christopher Hinton, chairman of the Central Electricity Generating Board, who said that the interconnection would offer economic advantages. The mid-winter peak demands for electricity in the two countries occurred at different times during the day: at 8.30 in the morning in France and at 5 o'clock in the afternoon in England. Because France obtained about half of her energy requirements from hydro-electric power stations on rivers fed by melting snow, her seasons of peak supply were the autumn and spring. In England, where the bulk of production of electricity was from coal-fired plants, surplus energy was most readily available in summer. An exchange of energy at these times would therefore be an advantage to both sides.

Describing the system, Sir Christopher said that it consisted of two 30-mile-long submarine cables between Dungeness Point and Boulogne, with three- to four-mile lengths of land cable at each end. Convertor stations, able to rectify from a.c. to d.c. and invert from d.c. to a.c., had been built at Lydd, in Kent, and Echingen, a suburb of Boulogne. The d.c. transmission would operate at 200 kV and would carry 160 MW in either direction.



The cross-Channel cable link being inaugurated by the Minister of Power, Mr. Richard Wood, as he speaks by telephone to M. Jean-Marcel Jeanneney, French Minister of Industry, at the Plessis Gassot control centre of Electricité de France. With the Minister is Sir Christopher Hinton, chairman of the C.E.G.B.

Before giving instructions to the control engineers to put the connection into operation, Mr. Richard Wood referred to the development of the grid system and pointed out that 35 years ago there was no national system of electricity transmission in Great Britain. Each area was served by its own stations, and the undertakings had to carry a high margin of plant in case of emergency. Now they had a highly-developed grid system linking their generating stations, which had made it possible to generate at the stations with the lowest cost and to spread spare capacity over the whole country. This clearly had brought great savings and it had helped to keep down the price of electricity.

Today the industry was taking a further important step forward. Until now we had linked our own generating stations; now we were linking our system with that of France. Mr. Wood said that the cross-Channel project was a most exciting development. It was the largest submarine cable of its length and capacity in the world. Apart from the cable, there was complicated equipment at each end. The electrical plant and supply industries of Britain, France and Sweden deserved the greatest praise for the results of their co-operation in its design and construction.

European Co-operation

Mr. Wood then spoke to M. Jeanneney over the television and radio link and emphasised the long history of co-operation between the electrical industries of Europe. Nations could not live in isolation today, and the cable was a welcome symbol of international co-operation. The electricity industries of Britain and France were setting an example entirely in the spirit of the wider economic union which was going forward in Europe at present. It had been harder for Britain to join this system because of the sea, but the engineers of the two countries, with the assistance of Sweden, had overcome this obstacle and made it possible for us to share the advantages of an internationally-connected system.

M. Jeanneney said that the link had a symbolic as well as a technical value. They were prepared to supply Great Britain with electricity up to the limit of 160 MW. He then asked Mr. Wood how much power he would like to receive. Mr. Wood replied that Britain would, at that moment, like to import 80 MW from France. M. Jeanneney said he would give the necessary orders so that the power would be supplied immediately, and he asked for the equivalent amount from Britain later that afternoon.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Electric Shock Treatment

I HAVE just seen the article in your issue of 10th November by Dr. Herald J. Gilbert entitled "Electric Shock Treatment." I find myself in so much disagreement with Dr. Gilbert that I would crave space in your journal to deal with a number of criticisms of the mouth-to-mouth method of artificial respiration which were raised by him.

First, while to some people the actual mouth-to-mouth (or mouth-to-nose) contact may be æsthetically unpleasant, surely the first-aider, who is aware that this technique is much more efficient than any of the manual methods previously taught, will not consider his own feelings when an asphyxiated casualty's life is at stake.

Secondly, while recognising that germs of disease may be spread from operator to casualty, one must think of the diseases which may be passed to the casualty by the operator. These are the common cold, influenza, and possibly tuberculosis. In this country we have now so controlled the prevalence of tuberculosis that transmission of this disease is extremely unlikely. I, personally, were I asphyxiated, would much prefer to run the risk of contracting these diseases from the operator than have, for example, the Holger Nielsen method performed on me. Remember that tuberculosis, although still a relatively serious disease, is now eminently treatable.

Thirdly, the possibility of an asphyxiating substance passing from casualty to operator is a theoretical objection in the extreme, and would not occur in practice.

Fourthly, it would require extreme pressure on the part of the operator to so over-inflate the casualty's lungs as to produce a tear there. If one thinks of the internal pressure produced in the chest on coughing, this explanation should be clear.

Fifthly, and this may be a radical departure from the previous training of your readers, in cases of drowning there is extremely little or no water in the lungs. Asphyxia is produced by spasm of the larynx closing off the air passages, therefore there is no point in attempting to drain the lungs of water.

Finally, the exhaled air from our lungs contains about 16 per cent oxygen after we have extracted 4 per cent from the inhaled air. The casualty is well able to extract a further 4 per cent from our exhaled air, and if we give, in addition, a sufficient quantity of air his blood is rapidly re-oxygenated.

May I conclude by saying that the three voluntary first-aid organisations, the St. John Ambulance Association, the British Red Cross Society and the St. Andrew's Ambulance Association, only adopted the mouth-to-mouth and mouth-to-nose techniques after raising all the possible objections to it and being convinced on the evidence available that these techniques are, without doubt, superior to the manual methods previously taught.

London, S.W.1. J. S. McLINTOCK,
Deputy Principal Medical Officer,
The St. John Ambulance Association.

Dr. Gilbert has seen a copy of this letter and replies as follows:—

I do not think that Dr. McLintock can have seen my last letter to your magazine. I agree *almost* fully with his comments. The objections raised to the mouth-to-mouth method of artificial respiration have been largely overcome as time has gone on, but cannot be entirely discounted or thrown aside so readily. Admittedly most are unlikely to occur, but if they do nothing more they have produced a basis for discussion which has therefore given rise to general interest in this subject, which is what I originally set out to do. I, too, would like to feel that all criticisms, difficulties and problems in relation to the form of artificial respiration have been overcome. This has largely been done but not completely.

It might be of interest to Dr. McLintock to know that in my experience, which includes duties as local police surgeon, I have had three cases of hæmorrhage and torn lung due to over-inflation by mouth-to-mouth blowing.

As a divisional surgeon to the St. John Ambulance Brigade I agree fully with Dr. McLintock's last paragraph that the mouth-to-mouth method has been adopted by the Association after raising all possible objections to it and finally being convinced that it is superior to the manual methods previously taught. I agree also that if a case actually arose one would not consider the unpleasantness of it but get on with mouth-to-mouth without hesitation.

Finally, I agree in general that mouth-to-mouth artificial respiration is simplest and best for most people and in most cases, but where a person has been trained in Holger Nielsen artificial respiration I would prefer them to use it in drowning and gassing cases. I hope that both methods will remain in the St. John training manual.

Low Fell, Gateshead. HERALD J. GILBERT, M.B., B.S.

Miniature Circuit-Breakers

MY attention has been drawn to the report of Mr. J. A. Robbins' lecture on miniature circuit-breakers in your 10th November issue. My company has had many years' experience of m.c.b.'s and this leads me to question some of Mr. Robbins' assumptions. While I agree wholeheartedly with his assessment of the advantages enjoyed by m.c.b.'s over old-fashioned fuses, I feel that it is most important that limitations based on different experience should not be put forward without refutation. Now that m.c.b.'s are at last being accepted in England, it is essential that full information about them should be made available publicly. I realise that editorial space is limited, but it is unfortunate that this should have resulted in your report emphasising unduly the results of one particular company's experience.

I am particularly concerned with your report's failure to point out the results that can be achieved simply and economically by using a bi-metallic trip in conjunction with an instantaneous electromagnetic trip. Compared with m.c.b.'s that employ ferrous slugs moving in hydraulic dashpots, much closer control can be secured, and much greater safety can be offered.

All types of m.c.b.'s are designed to protect circuits at a pre-set point above normal operating loads. User convenience demands that this point should be capable of variation without difficulty and expense. This is most definitely not the case with the magnetic hydraulic dashpot types. It is no understatement to say that to vary the pre-set operating level of m.c.b.'s of this type is a major operation.

I would stress also the greater protection that is offered by bi-metallic and electromagnetic trips. These give instantaneous protection the moment danger point is reached, no matter how little this point is above normal operating loads. In the case of hydraulic types set to protect at less than ten times the normal operating load there is time delay before protection is afforded. This delay may be critical. Instantaneous switching, on the other hand, makes it possible to isolate a faulty circuit immediately at any power level. Consequently, additional safety is achieved as it is possible to switch out a circuit at the very moment a fault occurs at a lower power level. My company is willing to recommend electromagnetic and bi-metallic m.c.b.'s for protection at ultra-low levels. As far as we are concerned, the successful application of m.c.b.'s at low protection levels is limited only by the existence of power surge when switching on.

Hungerford, Berkshire. C. A. F. FULLER-SHAPCOTT,
Managing Director,
Chilton Electric Products, Ltd.

Short-Circuit Ratings of Aluminium Cables

MR. A. G. THOMAS, in his article of 10th November, bases his claims on the short-circuit strength of aluminium cables on E.R.A. Report F/T195 by Messrs. Gosland and Parr, and Mr. G. S. Buckingham's recent I.E.E. paper, but surely he has "jumped the gun."

Mr. Buckingham stressed the importance of testing each type of cable and the danger of attempting to modify one set of test results in order to apply them to a different design of cable.

Readers who followed the discussion on Mr. Buckingham's paper, which related to cables with copper conductors, will find that Mr. Thomas actually invited the author's comments on some of the conclusions of his present article and was advised to await the publication of test results on cables with aluminium conductors.

It seems unfortunate that he has now chosen to disregard this advice.

"VERITAS."

Electrotechnical Commission Meeting

THE International Electrotechnical Commission recently held a two-week session of talks aimed at achieving international standards agreement on electronic components, equipment and testing procedures. Altogether, 160 delegates from 17 countries attended the meetings which were held at British Standards House, London. Fourteen committees and sub-committees met. First meetings were held of committees on printed wiring and computers and data processing.

Four new I.E.C. recommendations were approved for publication, including specification sheet No. 1 for rotary wafer switches, vibration test for connectors for use at frequencies below 3 Mc/s, amendments to the I.E.C. specification for sockets for electronic tubes and valves, and Test R, Container sealing, of Publication No. 68.

National Committees of the I.E.C. will be considering proposed revisions of tests for vibration fatigue, soldering, dry heat (additional severities) and vibration (resonance search) which will form part of Publication 68—Basic climatic and mechanical robustness testing procedure for components for electronic equipment. International standardisation of connectors for radio receivers and sound equipment moved into its final stages during the talks. Countries will have two months in which to suggest any final alteration to the proposed publication.

During the fortnight the first meeting was held of an I.E.C. committee on computers and information processing. Eleven countries were represented by over 50 delegates, ten of whom were from the United Kingdom data processing industry. The agreed scope of the committee was "to prepare international recommendations for electrical characteristics of computers and information process devices and systems including process control computers, machine tool control computers and others as developed." To implement this, four sub-committees were formed. They will cover output equipments; digital data transmission; analogue equipment in information processing systems; and input-output media. The committee will function in parallel with the companion committee set up by the International Organisation for Standardisation (ISO) to deal with aspects of all information processing work other than electrical. It will also work closely with I.E.C. committees dealing with the electrical side of machine tools as well as ISO committees dealing with machine tools and office equipment. One of the principal problems will be that concerned with the interconnection of various equipment systems.

Revised British Standards

THE scope of a new edition of B.S. 1432 : 1961, "Copper for electrical purposes. Strip with drawn or rolled edges," is limited to strip only up to 6in wide, and only strip whose edges or corners are finished by a process which gives closer tolerances on width than are given by slitting, shearing or other edge cutting processes. Strip over 6in wide, and strip or sheet of any width manufactured to greater tolerances on width, have been divorced from the standard and are now included in the revision of B.S. 899.

Requests that the sizes of drawings given in B.S. 308 and B.S. 1192 be brought up to date have led to the publication of a new standard, B.S. 3429, for the sizes of drawing sheets. Inquiries showed that the engineering industry in general wish to maintain the inch series based on the 30 and 40in paper widths, and that the 27 and 22in widths are tending to go out of use as 32 and 42in wide drawing boards are being installed on modern drawing equipment. However, the architectural and building industries desired "A" sizes selected from the International Organisation for Standardisation Draft Recommendation R 330. The standard has therefore been produced in two parts, the first dealing with engineering drawings, and the second with architects' and builders' drawings.

Copies of these standards may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1, price 7s 6d and 3s each, respectively.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Mr. J. E. Sunderland, a director of Enfield Cables, Ltd., and Enfield-Standard Power Cables, Ltd., has been elected chairman of the Cable Makers' Association for 1962.

Mr. D. G. Dagnall, A.M.I.E.E., has been appointed assistant manager, administration, in the Electrical Insulation Department of Turners Asbestos Cement Co., Ltd., and **Mr. F. H. Lomas,** B.Sc., A.M.I.E.E., becomes assistant manager, technical. Mr. Dagnall served an apprenticeship with the Liverpool Corporation Electric Supply Department and was later commissioned in the technical branch of the Royal Air Force. In 1946 he joined the Metropolitan-Vickers Electrical Co., Ltd., with whom he remained for 15 years, eight of which were spent as a sales engineer in Rio de Janeiro, Brazil.

Mr. D. G. Dagnall

Mr. F. H. Lomas

Mr. Lomas joined Turners Asbestos in May last year as technical sales engineer. Before this he spent 13 years with Metropolitan-Vickers, engaged in electrical design and development work, including the development of a single anode mercury-arc rectifier for use on a.c. multiple-unit train equipment.

Dr. D. J. Howarth (Ferranti, Ltd.) gave a lecture on the Atlas computing system at the Eastern Joint Computer Conference in Washington, D.C., this week. The lecture was based on a paper written jointly with Professor T. Kilburn and Dr. R. B. Payne of Manchester University, where the first Atlas computer is now being installed.

Thomas Bolton & Sons, Ltd., are reorganising their Sales Department and from 1st January **Mr. J. G. R. Warburton** will be transferred from Widnes to the Froghall works in Staffordshire to take charge of the new Sales Department as Froghall sales manager. From the same date, **Mr. A. R. D. Kitson** will take up his duties as London sales manager and will operate from 168, Regent Street, London, W.1.

Mr. James Fraser has been appointed manager of the Greenock, Scotland, factory of IBM United Kingdom, Ltd., which manufactures data processing equipment and electric typewriters. Mr. Fraser succeeds **Mr. A. McLeod,** who is returning to Canada as assistant plant manager at the Toronto factory of IBM Canada. Mr. Fraser has been works manager in the IBM factory at Kingston, U.S.A., since 1957.

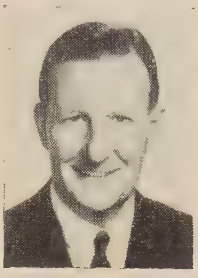
Mr. F. C. Jarvis has been elected chairman of the newly formed London Branch of the Electrical Trades' Commercial Travellers' Association. The vice-chairman and press steward is **Mr. E. R. Stickley** and the secretary **Mr. A. E. Shaw.**

Mr. R. Billington, T.D., D.L., M.Sc.(Eng.), M.I.E.E., has been appointed Inspector of Wireless Telegraphy in the Wireless Telegraph Section of the Post Office Radio Services Department in succession to **Mr. T. A. Davies,** O.B.E., who retires at the end of the year.

Mr. Michael J. L. Brook has been co-opted on to the board of Brook Motors, Ltd., as production director. Mr. Brook is the grandson of the late Mr. Ernest Brook, founder of the firm, and son of the present managing director. Educated at Wood Hall and Charterhouse, he completed a five-year course of technical training in the engineering industry. For two years he was head of the Technical Service Department before becoming assistant to the works manager.

Mr. M. J. L. Brook

The General Electric Co., Ltd., has appointed **Mr. A. J. Scamp** as personnel director with a seat on the board as from 1st January. Mr. Scamp has been released by Massey-Ferguson (U.K.), Ltd., with whom he is director of personnel and industrial relations. He is relinquishing his directorships of both Massey-Ferguson and F. Perkins, Ltd., at the end of the year.



Mr. A. J. Scamp

Mr. L. G. Hawkins has been appointed deputy chairman of British Electronic Industries, Ltd.

Sir John Macpherson has been appointed chairman of Cable & Wireless, Ltd., and its associated companies in succession to the late Sir Godfrey Ince. He will take up the post on 1st January. Sir John was born in Edinburgh in 1898 and has devoted most of his life to Commonwealth affairs. In 1954 he was appointed Governor-General of Nigeria and in 1956 Permanent Under-Secretary of State for Colonies. He retired from the Service in 1959.

Sir John Macpherson

Mr. M. L. Beswetherick has been appointed sales manager of the London Lamp and Lighting Department of the

The 31st annual ball of the E.I.B.A. Tyne & Wear Branch took place at Newcastle-on-Tyne on 5th December, when the guests were received by the chairman, Mr. C. St. L. Brightman, and Mrs. Brightman accompanied by Mr. and Mrs. J. Bennett. In the photograph Mrs. Bennett is presenting a bouquet to Mrs. Brightman (left)

Stearn Electric Co., Ltd. He has been a sales representative with the company since 1953.

The Midlands Electricity Board has appointed **Mr. E. H. Blacker,** LL.B., F.A.C.C.A., A.C.I.S., as manager of its Central Gloucestershire Area in succession to Mr. S. Raybould, M.I.E.E., who, as we have previously announced, becomes manager of the Board's Worcestershire Area on 1st January. Mr. Blacker, who has been Central Gloucestershire Area accountant/secretary since January, 1960, began his career with the County of London Electric Supply Co., Ltd. In 1955, while with the Eastern Electricity Board, he was awarded a Central Electricity Authority scholarship to become a full-time law student at London University.

Mr. E. H. Blacker

Mr. K. Sutherland, M.C., M.E.E., M.I.E.(Aust.), one of the pioneer engineers of the State Electricity Commission of Victoria, retired on 9th December after more than 40 years' service. For the past 12 years Mr. Sutherland has been engineer and manager of the Commission's Electricity Supply Department. He is succeeded by **Mr. K. L. Murray,** A.M.I.E.(Aust.), who joined the S.E.C. in 1924 and has been assistant engineer and manager since 1959.

The Minister of Power has appointed **Mr. C. W. Hannan,** works director of the Hackbridge & Hewittic Electric Co., Ltd., as a member of the South Eastern Electricity Consultative Council.

Over 350 members and guests, a record number, attended the Christmas luncheon meeting of the **Electrical Industries Club** on Tuesday. Mr. E. A. V. Peckham, the president, was in the chair and the guest speaker was Mr. Bernard Miles, the well-known radio and television artist and founder of the Mermaid Theatre. In keeping with the festive character of this particular function, Mr. Miles' talk was in light-hearted vein.

A collection on behalf of the older beneficiaries of the E.I.B.A. in response to an appeal by Mr. E. G. Batt, vice-president, realised a sum of over £160.

OBITUARY

Mr. George W. P. Page, A.C.G.I., A.M.I.E.E., who until his retirement at the end of 1953 was a member of the staff of the Publicity Department of the then British Thomson-Houston Co., Ltd., Rugby, died on 2nd December at St. Albans General Hospital. He was 72. His only son, Councillor A. E. P. Page, an engineer in the Maintenance Department, A.E.I. (Rugby), Ltd., is the present Mayor of Rugby.

Mr. John Waddell, who died on 2nd December at the age of 86, was one of the early pioneers of the lead acid battery. He joined Johnson & Phillips at Charlton at the age of 14 and there became associated with those who later formed the D.P. Battery Co., Ltd., of Bakewell—an association that lasted 72 years. During that time he was successively works manager, general manager, managing director and chairman of the company. Ill-health compelled him to relinquish the chairmanship five years ago although he remained on the board.

The late
Mr. John Waddell

Sir William Robinson, who died in Belfast on 11th December at the age of eighty-two, was chairman of the Electricity Board for Northern Ireland from 1944 to 1952. He was also chairman of a commission set up to report on electricity supply in the Isle of Man.

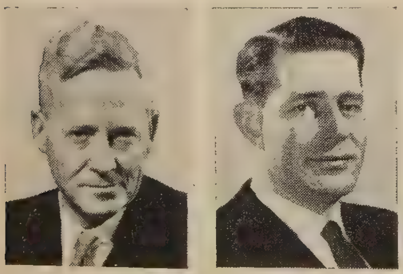
Mr. E. J. Brett.—The death occurred at Maelor Hospital on 22nd November, after a short illness, of Mr. E. J. Brett, A.M.I.E.E., who had been district manager for the Merseyside and North Wales Electricity Board at Wrexham since 1955. He was 57. After serving on the engineering staff of the L.M.S. Railway at Crewe, Mr. Brett began his career in the electricity supply industry in 1932 when he joined the Electricity Distribution of North Wales, Ltd. Later he served as district mains engineer and operations engineer with the North Wales Power Co. and on the nationalisation of the industry he became district engineer at Wrexham.

The late
Mr. E. J. Brett

WILLS

Mr. J. S. Akroyd, principal of the firm of Thomas & Akroyd, Halifax, electrical engineers, who died on 8th October last, left £52,369 gross (£51,655 net).

Mr. E. S. Waddington, M.I.E.E., manager of the industrial division of Philips Electrical, Ltd., 1933-57, who died on 6th August last, left £8,059 gross (£7,668 net).



As reported in last week's issue, Dr. J. R. Mortlock (left) has been appointed assistant chief engineer (engineering services), A.E.I. (Manchester), Ltd. Mr. D. M. Paterson (right) becomes assistant superintendent, Large Industrial Machines Department, A.E.I. Motor and Control Gear Division

DIESEL AND ELECTRIC TRACTION

A SERIES of lectures on "British Railways Experience with Diesel and Electric Traction" was given in March this year by Mr. E. S. Cox, deputy chief mechanical engineer of British Railways, when he visited the South African, Rhodesian and East African Railways under the auspices of the United Kingdom Railway Advisory Service. The text of Mr. Cox's paper, with a verbatim record of the discussion which followed at Witwatersrand University, is contained in a booklet published by H.M. Stationery Office, price 3s.

The paper covers the practical experience obtained with diesel power units using both electrical and mechanical transmissions, and with high voltage a.c. locomotives and multiple-unit trains. Future developments are considered in each case.

Vacuum Recloser

A report in the *Electrical World* (New York) describes a high current circuit recloser which interrupts power arcs in vacuum and has been developed by the American General Electric Co. This new vacuum recloser has a rated interrupting capacity of 8,000 A at 15·5 kV and 12,000 A at 4·8 kV. The recloser's clearing time is less than two cycles, including fault sensing, tripping and circuit interruption. It is believed to be the fastest heavy-duty circuit recloser available today.

INDUSTRIAL NEWS

Electricity Borrowing Powers

WITH the increase in the demand for electricity and the rise in costs and prices the borrowing powers of the Electricity Council and Area Boards and the South of Scotland Electricity Board have proved insufficient. Under orders laid before Parliament last week the Minister of Power proposes to raise the borrowing limit of the Electricity Council and Boards from £1,800 million to £2,300 million and the limit for the South of Scotland Board from £110 million to £135 million.

Provision for such an increase was made under the Electricity (Borrowing Powers) Act, 1959, when it was then expected that the lower figures would suffice until some time in 1961-62. The Boards are, however, now approaching these limits and it is necessary to raise them in order to provide for the remaining years of the programmes. But a White Paper* published last week says that it will probably be necessary to seek fresh borrowing powers during 1962-63.

The estimated total capital requirements of the Electricity Council and Boards over the seven-year period 1958-65 are now likely to be £210 million higher than forecast in 1958 and the requirements of the South of Scotland Board are likely to be £27 million more. Rather less than half these increases are attributed to the increases in costs and prices, the remainder being required to meet the higher rate of increase in demand. The increase in England and Wales would have been larger but for the revision of the nuclear power programme with the consequent substitution of cheaper conventional plant for some nuclear plant over the next few years, and the continuing reduction in the cost per kilowatt of conventional power plant. As, however, the targets to be set by the Government in accordance with the White Paper on " The Financial and Economic Obligations of the Nationalised Industries " (Cmnd. 1337) will call for higher rates of financial return, the industry expects to meet the greater part of the additional expenditure from its own resources. The self-financing ratio for the four years 1961-62 to 1964-65 is expected to be about 50 per cent.

The total capital requirements of the Electricity Council and Boards for the period 1st April, 1958, to 31st March, 1965, are now estimated to be £2,340 million, although the investment programmes for the last two years have not yet been approved by the Government. Of this amount £1,100 million will be financed internally. Over the period vesting day to 31st March, 1965, capital expenditure will amount to £4,039 million, with £1,659 million provided internally. The investment programmes for 1962-63 were published in the *Electrical Review* of 10th November.

* " Memorandum on the Electricity (Borrowing Powers) Order, 1961, and the Electricity (Borrowing Powers) (South of Scotland Electricity Board) Order, 1961," Command 1564, price 8d, H.M. Stationery Office.

ELECTRIC COOKERS TESTED

BOTH three-plate and four-plate electric cookers were the subject of recent tests carried out by the Consumers' Association, Ltd. Fourteen different cookers were examined—at least one from each British manufacturer and one Canadian model—and the findings were made known in the December issue of *Which?* The report shows considerable differences between one cooker and another. From among the three-plate types, the Association was unable to select any one model as a " best buy." Almost as much difficulty was experienced in selecting a " best buy " from among the four-plate cookers and two shared the honour—the Jackson " Highline 494T " and the " Creda Mercury Super-Four."

Comparing electric cookers with gas cookers, the subject of a similar report (*Which?*, October), the report concludes that electric cookers were found to be kinder to paintwork; more mobile; had more useful cooking space within the oven; more were fitted with roasting spits; and all had, or could have, automatic oven timers. For the basic models gas cookers were cheaper than electric cookers but when provided with such extras as oven timers, spits, thermostatic hotplate controls, etc., there was little difference in price. Hire-purchase charges, through the respective Boards, were stated to be lower for electric cookers.

Debate on Hire-Purchase Bill

THE Bill sponsored by Mr. W. T. Williams (Labour) and other Labour M.P.s to widen the scope of hire-purchase law and give more protection to customers failed to get a second reading. The Government advised M.P.s to reject it in view of the report of the Committee on Consumer Protection (the Molony Committee) due next year.

During the debate Mr. Philip Goodhart (Cons., Beckenham) suggested that the vigorous door-to-door salesmanship of the Rolls-Electromatic Group—a type of salesmanship criticised in the debate—had enabled them to capture a third of the market for washing machines, with a production of 1,700 machines a week. The Colston dishwasher also had a large share of its respective field. He alleged that these machines had attracted an unprecedentedly large number of complaints from dissatisfied customers. Mr. Goodhart said he had been asked to draw attention to the activities of this group by the Consumer Advisory Service, supported by the director of the Consumers' Association and the director of the Retail Trading Standards Association.

The charge was rebutted by Mr. R. Reader Harris (C., Heston and Isleworth), chairman of Rolls Razor, who said that Mr. Goodhart's remarks had been " mischievous and unjustified." There was nothing wrong with high pressure salesmanship provided there was no misrepresentation or deception.

In a statement issued after the debate the Rolls-Electromatic Group pointed out that " (a) they have in excess of 150,000 satisfied customers at this time; (b) the 250 complaints referred to by Mr. Goodhart cover a period of nearly four years—and that over 100 of these were from people who were simply waiting for delivery of machines. During that same period no less than 500,000 inquiries were received and dealt with successfully; (c) the hire-purchase debt of the company is 0·06 per cent—far less than average."

E.T.U. Case Appeals

Four of the five defendants in the Electrical Trades Union case in the High Court last summer are not proceeding with their appeal. They are Mr. Frank Haxell, former general secretary, Mr. Robert McLennan, assistant general secretary, Mr. James Humphrey, office manager, and Mr. Jack Frazer, a member of the Union's Executive Council.

Mr. Frank Foulkes, E.T.U. president, the fifth defendant, has said he intends to proceed with his appeal.

PROPOSALS FOR MARKING IMPORTED REFRIGERATORS

ALL refrigerators imported into this country may soon have to bear an indication of their origin. In a White Paper ("Report of the Standing Committee Respecting Refrigerators," Cmnd. 1534, H.M.S.O., price 8d) published last week, the Standing Committee Respecting Refrigerators recommends to the Board of Trade that an indication of origin should either be incorporatetd in any trade nameplate appearing on the front of the refrigerator or should be printed or stamped on a label securely and prominently displayed in the interior.

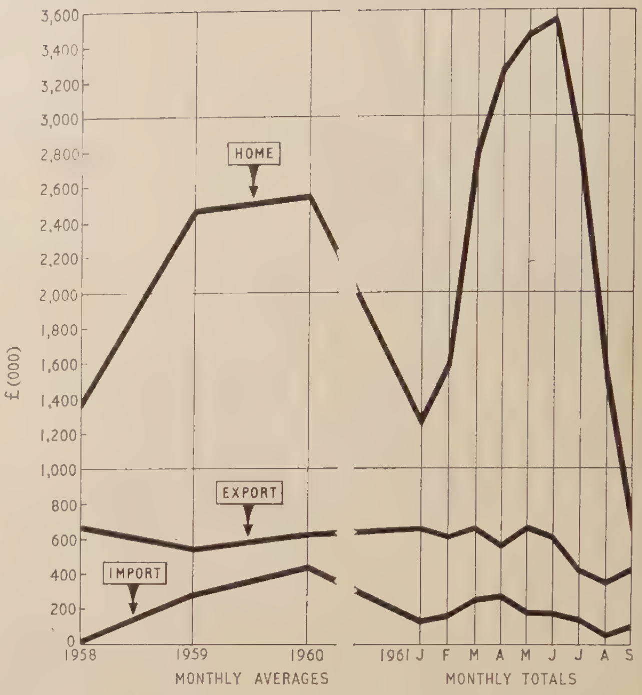
The Committee rejected the suggestion that the marking should apply at the time of import and considered it was sufficient if the refrigerators were marked in the manner indicated at the time of sale, both wholesale and retail. The recommendation applies to both domestic and commercial refrigerators. The latter include deep freeze cabinets, display cabinets, frozen food cabinets, service cabinets, ice cream conservators and farm freezers. The Committee suggests that an Order in Council should be made to come into force after a period of six months.

The question of labelling imported refrigerators was referred to the Committee on 30th January, 1961, by the Board of Trade as a result of an application by the British Refrigeration Association, supported by the British Electrical and Allied Manufacturers' Association and the Domestic Refrigeration Development Committee. It was opposed by the following companies:—Atlas Refrigeration; Bosch, Ltd.; the Brattel Electric Co., Ltd.; Edmundsons Supply Corporation, Ltd.; Electro Appliances & Equipment, Ltd.; Lonor, Ltd.; and Welmec Corporation, Ltd.

British Manufacturers' Case

British manufacturers argued that with the increase in imports in recent years the consumer in many cases bought an imported refrigerator under the impression that it was British. They did not suggest that only refrigerators made in this country were of good quality but maintained that the public should be able to make an informed choice. Another reason why the applicants considered purchasers might wish to know the origin of a refrigerator was in connection with the supply of spares and the fact that foreign manufacturers did not always use the British colour code in wiring.

It was agreed that a high proportion of foreign manufacturers marked their refrigerators but there was no legal obligation on them to do so. The opponents to the application maintained that it would be wrong to require refrigerators to be marked in a way which might impair their saleable quality and they pointed out that an indication of origin already appeared on a plate at the back which, they said, was the normal place to find it. They also submitted that an Order providing that the front of the refrigerator cabinet should be marked would be a discrimination against imported refrigerators which would lead to retaliation abroad. The Committee, however, decided that an indication on the back was not sufficiently conspicuous.



Comparison of British manufacturers' production of domestic refrigerators for home and export and imports of foreign refrigerators

Deliveries and Imports

The recent trends in the production of refrigerators by British manufacturers for home and export and the level of imports are shown in the graph. The latest figures issued by the Domestic Refrigeration Development Committee, which are less comprehensive than the Board of Trade figures used in the graph, show that October deliveries of British-made domestic refrigerators to the home market totalled 26,098. This was a decrease of 18·6 per cent on the October, 1960, figure of 32,057. Total deliveries for the first ten months of the year were 744,450, a decrease of 13·9 per cent on the total for the same period last year—864,643.

Deliveries to overseas markets, however, at 8,457, were 6 per cent more than a year ago. This improvement is the first since January.

Aid for Exporters to West Germany

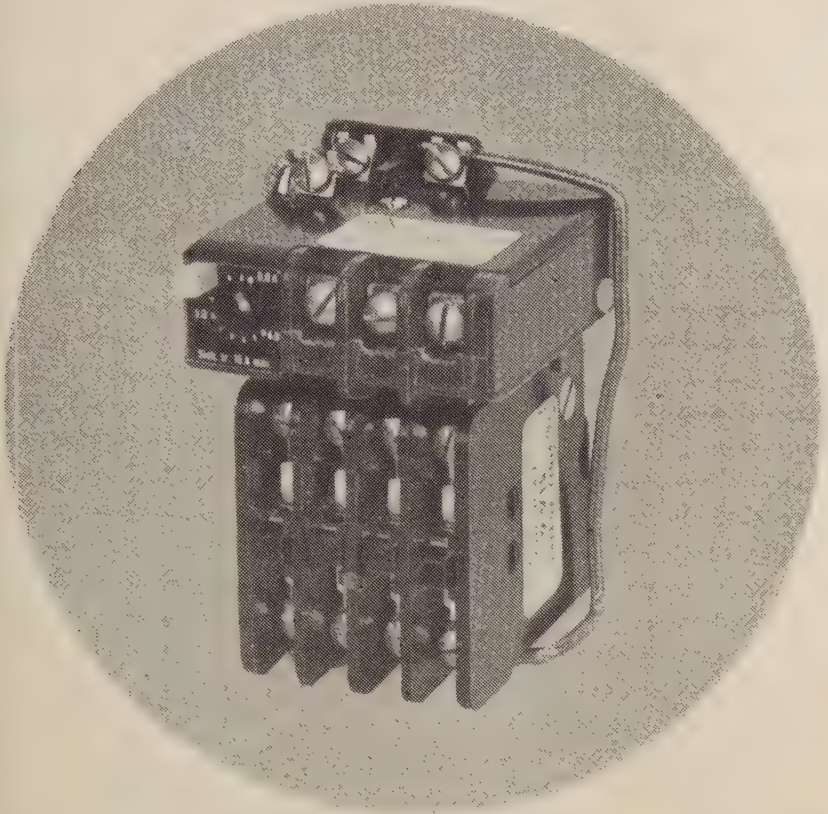
A NEW scheme to promote and assist British exports to West Germany has been devised by Wm. Brandt's Sons & Co., Ltd., the bankers. Although primarily of appeal to small- and medium-sized manufacturers wishing to enter the German market, the scheme may also assist companies already exporting by providing a factoring service and in making available credit facilities to the buyer in approved cases equal to those available from manufacturers in Germany.

Among the facilities offered are *full* payment in cash against documents at time of delivery f.o.b. U.K. port; assessment of the market potential for particular goods; and the selection of agents.

Banking and factoring services are the bases of the scheme, but Brandt's will also advise and assist manufacturers with all facets of procedure, including shipping, documentation, etc. Medium-term finance for capital machinery, etc., may also be arranged by separate negotiation.

SCOTTISH ELECTRICAL EXHIBITION

In recent years the North of Scotland Hydro-Electric Board has sponsored successful electrical exhibitions at Perth, Dundee and Aberdeen and next year it is organising a similar event at Elgin from 10th to 14th April. The Board states that the exhibitions have proved worth while both in load building and as a sales outlet for manufacturers and it invites those who have not taken part previously to help to widen their scope still further.



STOTZ

CONTACTOR

SLA 6

6 A. 500 V.

WITH THERMAL OVERLOAD RELAY TYPE T.S.A.

- RIGHT PERFORMANCE
- RIGHT DIMENSIONS
- RIGHT PRICE
- RIGHT DELIVERY

CONTROL CONTACTORS

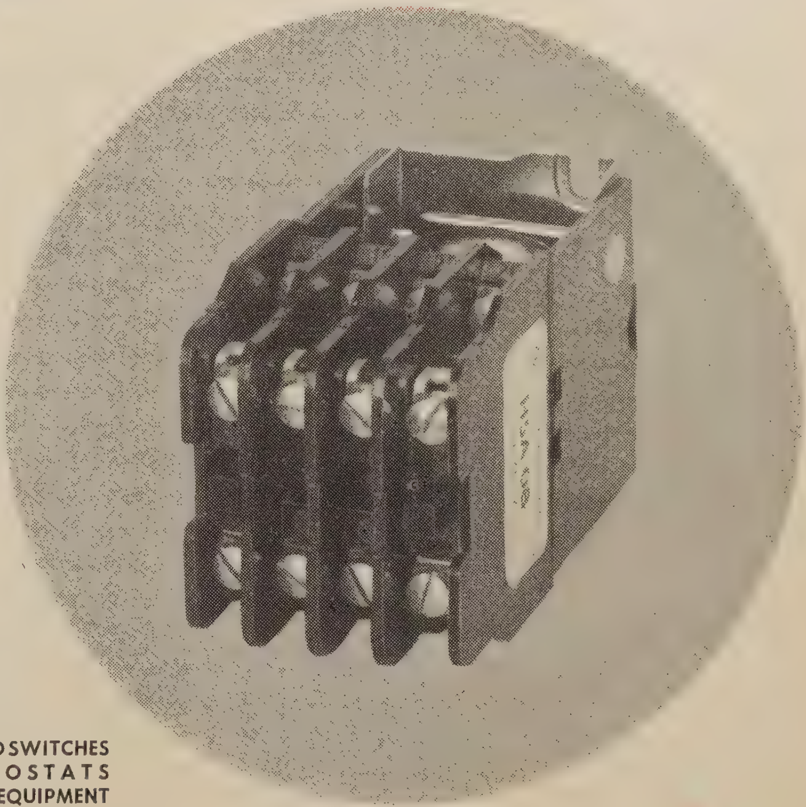
RATED 6 A. 380 V.
(with contact changeability)

HSA 04
with 4S, 2S + 2ϕ, 3S + 1ϕ.

HSA 08
with 8S, 4S + 4ϕ

and other combinations

S = Closing contact
ϕ = Opening contact



Other STOTZ products

MINIATURE CIRCUIT BREAKERS - RELAYS - MICROSWITCHES
PRESSURE SWITCHES - THERMOSTATS
BALLASTS - FLAME IGNITION CONTROL EQUIPMENT
EXPLOSION AND FLAMEPROOF SWITCHGEAR

Write for further details of Contactors and other products

BRITISH BROWN-BOVERI LTD.

75 VICTORIA STREET, LONDON, SW1
Telephone: ABBey 5777 (3 lines) Telex No. 23448

FOR THE FIRST TIME IN BRITAIN—
AN ENTIRELY NEW RANGE OF AIR CIRCUIT BREAKERS

An agreement has been concluded whereby the Control Gear Division of G.W.B. has been appointed sole licencees in Great Britain for the complete range of Automatic Air Circuit Breakers manufactured by SACE of Bergamo, Italy.

Small and compact, and with an extremely high making and breaking capacity, these offer many advantages over breakers available so far. Ranging from 60 amps to 4,000 amps in 2 pole, 3 pole and 4 pole designs, they are fully tested and approved for industrial and marine use.

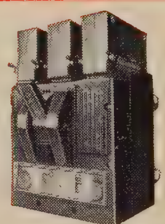
Various methods of mounting, e.g. plug-in, surface or flush, front or back connected are available to suit individual requirements, together with a comprehensive range of ancillary fitments. Full details will be sent on request.

GWB

CONTROL GEAR

CONTROL GEAR DIVISION G.W.B. FURNACES LIMITED
DUDLEY · WORCESTERSHIRE · TELEPHONE: DUDLEY 55455

Associated with Gibbons Bros. Ltd. and Wild-Barfield Electric Furnaces Ltd.



Type Z 630-600 amp air circuit breaker having a K.E.M.A. certified breaking capacity of 20 KA at 500 volts AC. (equivalent to 15 MVA at 415 V.A.C.)

Section of a typical L.V. Distribution Switchboard using Z 630 Draw-out pattern air circuit breakers in multi-tier formation.

Reorganisation of J. & P. Home Sales Department

IN consequence of the substantial growth of the company's sales of both plant and cable over recent years, Johnson & Phillips, Ltd., announce a reorganisation of their Home Sales Department to take effect from 1st January. Mr. J. C. Robertson, D.F.H., M.I.E.E. (home sales manager) will now head two sales organisations, one handling the products of the cable and junction box departments and the other those of the plant departments, which include switchgear, transformers and capacitors.

Cable Sales Organisation

The new Cable Sales Organisation is managed by Mr. C. W. Cawte, B.Sc.(Eng.), A.M.I.E.E., and is based on the company's old branch organisation with certain merging of areas for more efficient working. There will, however, be no reduction in the number of cable stores.

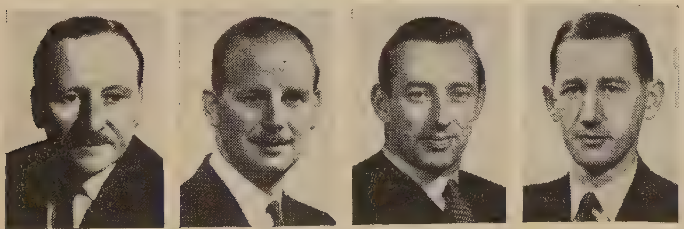
The United Kingdom will now be divided into ten areas with area sales offices in London, Portsmouth, Ipswich, Bristol (with a sub-office at Exeter), Nottingham, Birmingham (sub-office at Cardiff), Manchester (sub-offices at Bradford and Sheffield), Newcastle, Glasgow (sub-office at Edinburgh) and Belfast. In most cases the present branch manager takes over the new area as area manager (cable), but among the changes are the following:—Mr. F. Williams, Associate I.E.E., previously manager of the Bristol branch, returns to Birmingham to manage the Birmingham Area which is now expanded to include South Wales. Mr. P. C. G. Dougherty, previously manager at Sheffield, takes over the Bristol Area. The Manchester Area, under Mr. A. F. Herbert, A.F.C., has been expanded to include the territories previously covered by the Sheffield and Bradford offices, with sub-area offices in these cities. Mr. D. W. Gregory, D.F.H., A.M.I.E.E., previously manager of the Glasgow branch, is now area manager (cable) for Scotland.

Plant Sales Organisation

Mr. R. L. Stanley, D.F.H., A.M.I.E.E., is manager of the Plant Sales Organisation which will be divided into four areas, the boundaries of which are related to the boundaries of the Electricity Boards.

The Southern Area, covering the territories of the Eastern, Southern, London and South Eastern Electricity Boards, will be under the control of Mr. R. A. Jones, A.M.I.E.E., who also remains as manager of the London Area for cable. The Eastern Area covers the territories of the North Eastern, Yorkshire and East Midlands Electricity Boards. Mr. G. Hyson, A.M.I.E.E., previously Bradford branch manager, will be sales manager (plant) for the area and will be based at Sheffield with sub-area offices at Newcastle, Bradford and Nottingham. The Western Area covers the territories of the North Western, Merseyside and North Wales, Midlands, South Wales and South Western Electricity Boards. Mr. P. H. Dearle will be sales manager for the area operating from Manchester with sub-area offices at Birmingham, Cardiff, Bristol and Exeter. The Scotland and Northern Ireland Area will be managed by Mr. J. T. Easter, previously manager of the Edinburgh branch, who will be based in Glasgow with sub-area offices in Edinburgh and Belfast.

As part of this reorganisation J. & P. have also appointed two regional sales managers for contract work: Mr. H. M. Fricke, B.Sc.(Eng.), M.I.E.E., previously Birmingham branch manager, will be responsible for the North of England, the Midlands and Wales, and Mr. L. A. Thress, A.M.I.E.E., for Southern England, Scotland and Northern Ireland.


Top row (left to right): Messrs. F. Williams, P. C. G. Dougherty, A. F. Herbert and D. W. Gregory

Messrs. G. Hyson, P. H. Dearle, J. T. Easter, H. M. Fricke and L. A. Thress

TOOL MANUFACTURERS' TAKE-OVER

Stanley Works (G.B.), Ltd., have agreed to purchase all the shares in S. N. Bridges & Co., Ltd., from John Brown & Co., Ltd., and from the minority shareholders. Mr. O. D. Tannett, managing director of Stanley's, says that Bridges will continue to manufacture and operate independently and that the management of Bridges has agreed to continue under the present managing director, Mr. G. N. Bridges, founder of the business. The acquisition of Bridges, Mr. Tannett says, will enable both companies to continue to expand in both the domestic and export markets.

DISTILLERS PLASTICS GROUP

The title of the Distillers Company, Ltd., gives little indication of its wide scope. For instance, the company is now one of the leading producers of plastics, having entered this field in 1937 when it acquired British Resin Products, Ltd. Later it linked up with F. A. Hughes & Co., Ltd., and it also formed two companies in association with American concerns—British Geon, Ltd., and Distrene, Ltd. The Distillers Plastics Group now has factories on a 200-acre site at Barry, Glamorganshire, and employs about 1,800 people. The company has a number of other plastics interests.

An account of the group's activities is given in a 40-page brochure which the company has just produced, mainly for circulation overseas. It is profusely illustrated and besides briefly describing the production units and processes also deals with the services which the group provides and illustrates a number of applications of its materials.

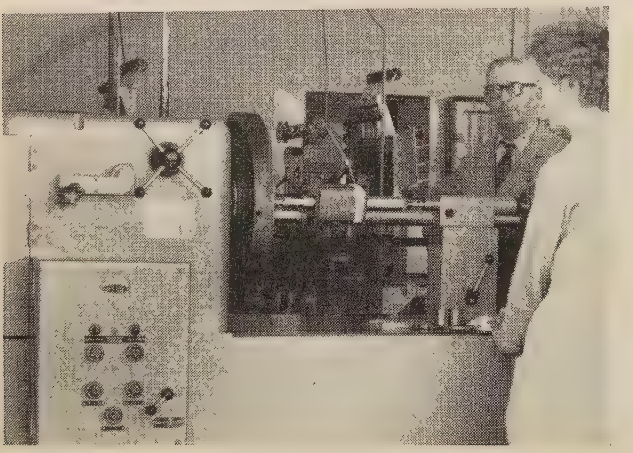
Board's New Glasgow Showroom

Today (Friday) the South of Scotland Electricity Board's large new showroom at 74, Sauchiehall Street, Glasgow, is being officially opened by Mr. Duncan Macrae.

Faceplate Winder for Transformer Factory

A HEAVY duty faceplate winder with a 17in faceplate has been specially developed by Westool, Ltd., St. Helen's Auckland, Co. Durham, for use in the new transformer factory which they have recently opened near to their main works. The machine is equipped with a constant tension stand which comprises a Warner electric brake mounted on a reel carrier spindle and actuated through a dancer pulley resting on the outer periphery of the wire so that as the effective diameter of the wire content varies the feed-back to the electric brake is controlled and a constant braking is maintained. It has a four-speed gearbox giving speed ranges of 0-20, 0-40, 0-75 and 0-205 r.p.m. Other speed ranges can be provided if required. The tailstock is adjustable and the machine can accommodate wire from 0·5 to 0·05in diameter.

The reversing mechanism comprises two Warner electric brakes coupled to two worm wheels in constant mesh with two lead screws. Adjustable stops actuate microswitches which, in turn, energise and de-energise the Warner electric brakes giving positive and instantaneous reversal of direction. The d.c. electric clutch and brakes are supplied from a metal rectifier which, complete with the necessary transformer, relays and fuses, is housed in a control panel. A hinged door gives access to the equipment.



Faceplate coil winder in the Westool transformer factory

Water Power in South Africa

The engineering consultant for the World Bank, Dr. Henry Olivier, has said that South Africa could profitably embark on hydro-electric chemes on the Orange, Vaal and Tugela-Pongola River systems and that these would assist the establishment of industries on the borders of the Bantu homelands. He envisaged a system of multi-purpose dams similar to the Snowy Mountains development in Australia and estimated the potential of the Orange River as four or five projects developing at least 1,000 MW. Three possible dam sites in the Transkei alone could provide nearly as much electricity as the entire Natal production, Dr. Olivier said.

Diesel Plant for I.O.M.

A repeat order for a Mirrlees/Brush diesel generating set has been received by Mirrlees, Bickerton & Day, Ltd., from the Isle of Man Electricity Board. The plant, which will be installed at Ramsey power station, consists of a Mirrlees KVSS 12-cylinder diesel engine developing 3,096 b.h.p. at 428 r.p.m., direct coupled to a 2,200 kW Brush alternator. By the end of 1962, a total of 15 Mirrlees/Brush sets will be in operation in the Isle of Man—at Pulrose, Peel and Ramsey.

SLURRY-FIRED POWER STATION

THE Secretary of State for Scotland has granted consent for the construction by the South of Scotland Electricity Board of a new generating station at Methil Docks, Fife.

The fuel to be used will be washery slurry. The station will consume some 250,000 tons annually and will solve the problem of the disposal of this material, which is of no value for any other purpose. The installation will consist of two 30 MW turbo-alternators operating at 900 p.s.i. and 900° F. The two boiler units will have a maximum continuous evaporative capacity of 275,000 lb of steam per hour. The single chimney will be 300ft high and the maximum height of the main building will be 120ft. Circulating water amounting to 3 million gallons per hour will be drawn from the Firth of Forth.

The cost of the station is estimated at £5 million and it is scheduled to be commissioned in 1965-66. The architects are Messrs. Ross-Smith & Jamieson, Edinburgh, the civil consultants Messrs. Kinnear & Gordon, Edinburgh, and the electrical and mechanical plant will be engineered by the Board's own staff. Construction is to begin shortly and at the peak some 375 workers will be employed.

CLEAN AIR

Next year the name of the exhibition organised by the National Society for Clean Air in conjunction with its annual conference is to be changed to the Clean Air, Fuel Efficiency and Domestic Heating Exhibition. The exhibition will be held at Harrogate from 9th to 12th October.

ELECTRICITY SALES AND CONSUMERS

THE latest quarterly return of electricity sales according to the different classes of consumers issued by the Electricity Council includes for the first time figures for the two Scottish Boards. It will be seen from the accompanying table that the highest rate of development continued to be in the domestic field.

The figures given in the table refer to kWh metered or billed during the period concerned.

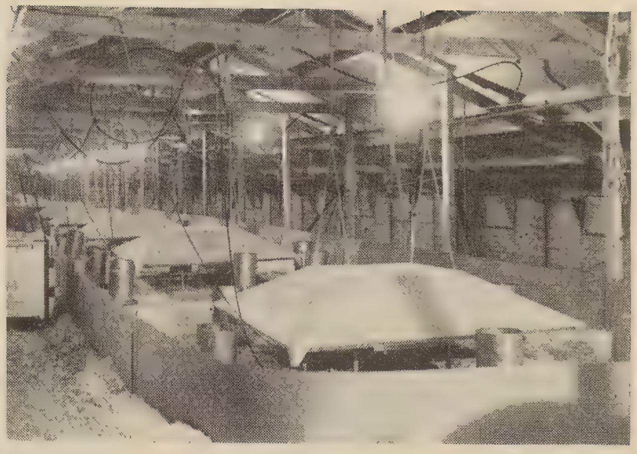
Class	Three months ended 30th September Million kWh	Increase over similar period of previous year %	Twelve months ended 30th September Million kWh	Increase over similar period of previous year %
Domestic	7,333·4	+14·3	36,980·5	+16·4
Farm	446·4	+10·4	2,171·3	+15·0
Commercial	2,584·2	+10·2	13,903·7	+11·8
Combined Domestic/Commercial	334·5	+ 9·9	1,637·2	+11·6
Industrial	11,673·2	+ 2·1	51,384·2	+ 4·8
Public Lighting	203·1	+ 9·1	975·9	+ 8·5
Traction*	411·4	+ 2·8	1,690·9	+ 2·8
TOTAL	22,986·2	+ 7·0	108,743·7	+ 9·7

* Excluding supplies for battery vehicles which are included under commercial or domestic tariffs.

Electricity in the Poultry Industry

In order to bring before producers the latest electrical techniques in chick rearing, the Electrical Development Association this year re-entered the National Poultry Show, which was held last week at Olympia. On the Association stand the advantages of electric heating by heat storage methods and the economies made possible by off-peak operation were stressed. Operating examples of two methods—by warmed floor or block storage units—were demonstrated, with live chicks. The Eastern Electricity Board was responsible for the development of the warmed-floor "Floorstone" brooder and installations suitable for from 250 up to 15,000 chicks have been provided. The method of construction is to excavate to a depth of about 15in. An inch of sand is then laid to provide a level base, and this and the sides are lined with polythene sheeting or other damp-proof material. They are then further lined with an inch of heat-insulating material (such as rigid glass fibre) and this is followed by concrete or sand in layers with the heating cables placed between. Two or more layers of cable are required.

The second method shown, the "Purlac" heat storage brooder, is suitable for up to 1,000 chicks in a properly insulated building. Operated through a time switch, it may be supplied at off-peak tariff rates, heat being stored in fireclay blocks encased in an insulated container.



A 15,000 bird poultry house in Sussex equipped with fifteen 3 kW block storage brooders

New E.D.A. Publications

Coinciding with the Poultry Show, E.D.A. have announced the publication of two new books on poultry husbandry, one of which deals with storage brooders. Entitled "Electricity and Storage Brooders for Poultry Rearing," it fully covers the principles and methods of applying the technique. Capital outlay and operating costs are given and it is shown that these compare very favourably with other methods. The publication is based on papers read at E.D.A. Rural Electrification Conferences and the joint authors are Mr. E. C. Claydon (Eastern Board) and Mr. G. P. Print (South Eastern Board).

The second publication, "Electricity and the Influence of Light upon Poultry Husbandry," gives authoritative data and recommendations regarding light patterns in order to obtain larger eggs and increased production. It is based on a paper by S. Fox (Reading University) read at the 1961 E.D.A. Rural Electrification Conference. The 14th in the Association's series of agricultural broadsheets, also just published, is entitled "Heat Storage Brooding." All are available from Electricity Boards or direct from the Association, 2, Savoy Hill, London, W.C.2.

Computer for Sydney University

A KDF9 electronic computing system has been ordered from the English Electric Co., Ltd., for the School of Physics at Sydney University. Its main functions for the University will be research and testing in the field of automatic computation and providing a computing service for the University. The English Electric Co. will use the Sydney KDF9 to build up a time-hire service for Australian and New Zealand commercial and industrial organisations and Government agencies. Customers of the English Electric bureau will be able to take over and operate the system with their own computer teams or make use of the company's bureau staff to process their problems.

Trade Announcements

Associated Electrical Industries, Ltd., has opened a district office at Alma Street, Coventry (telephone: Coventry 24181). Mr. R. C. Jenkin has been appointed manager. The office is responsible for sales of general industrial products made by A.E.I.

Several departments of the **Martindale Electric Co., Ltd.,** have moved into new offices at Movitex House, 6, Empire Way, Wembley. The company occupies the two top floors and the offices include the board room, sales departments, accounts and export departments. The design and production departments will continue to occupy the existing premises in Westmorland Road and Lowther Road, Queensbury, N.W.9.

Mr. W. F. Mortin, senior technical representative of **Advance Components, Ltd.,** now represents the company in the South of England. He is succeeded in the Midlands by Mr. A. D. Baseley. Mr. B. Scott has been appointed technical representative for South East England and South and West London.

Expert Industrial Controls, Ltd., of Ashby-de-la-Zouch, have formed a wholly-owned subsidiary, La Telecommande Industrielle S.a.r.l., 5, Rue Boudreau, Paris 9e, which will handle the marketing of "Decco" solenoids and "Loxswitches" in France and Belgium. Mr. Hugh Bolton, E.I.C.'s European sales manager, will be based at the Paris office temporarily and from there he will control the company's European operations. All European production will be undertaken by their German subsidiary, Expert Steuergerate G.m.b.H., Oer-Erkenschwick, near Recklinghausen, whose factory will shortly be in full production.

A. P. T. Electronic Industries, Ltd., announce that they have acquired the lease of premises in Oyster Lane, Byfleet, adjacent to their factory in Chertsey Road, Byfleet. The additional area amounts to approximately 14,000 sq ft.

The Engineer's Tools Department of **George Cohen, Sons & Co., Ltd.,** has been moved to the company's new machine tool headquarters at 23-25, Sunbeam Road, London, N.W.10 (telephone: Elgar 7222).

Wilkins & Mitchell, Ltd., announce that the South Wales divisional sales office for Servis washing machines is now 58a, Clive Road, Canton, Cardiff (telephone: Cardiff 25857).

Magco, Ltd., have now moved their London office to 132-135, Sloane Street, S.W.1 (telephone: Sloane 9976).

NEW ELECTRICAL EQUIPMENT

MOULDED CIRCUIT-BREAKERS

The Control Gear Division of G.W.B. Furnaces, Ltd., Dibdale Works, Dudley, Worcs., have been appointed sole licensees in Great Britain for the complete range of moulded case automatic air circuit-breakers designed by the Sace company of Bergamo, Italy. These range from 60 A to 4,000 A in 2-pole, 3-pole and 4-pole designs. Two ranges are at present offered, the Isol series type Z up to 600 A and the Otomax range, covering 800/4,000 A. Various methods of mounting—plug-in, surface or flush, front or back connected—are available to suit individual requirements, together with a comprehensive range of ancillary fittings.

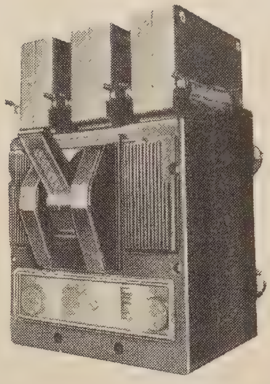
HIGH VOLTAGE CAPACITANCE STANDARDS

The range of capacitance standards for laboratory applications supplied by Aveley Electric, Ltd., Ayron Road, Aveley Industrial Estate, South Ockendon, Essex, has been extended by the introduction into the United Kingdom of a high voltage standard manufactured by Richard Jahre. This is a standard capacitor with air dielectric designed for measuring capacitances and dielectric loss with high voltage Schering bridges. With these standards the dependency of the capacitance and loss factor on the volttage is negligible. The loss factor (tan δ) is less than 1 in 10^4, measured at rated voltage and 50 c/s. The capacitance value of this component is 1,000 pF and the rated voltage is 6 kV, but capacitors can be supplied to order with other capacitance values and voltages. All capacitors are delivered with a calibration certificate.

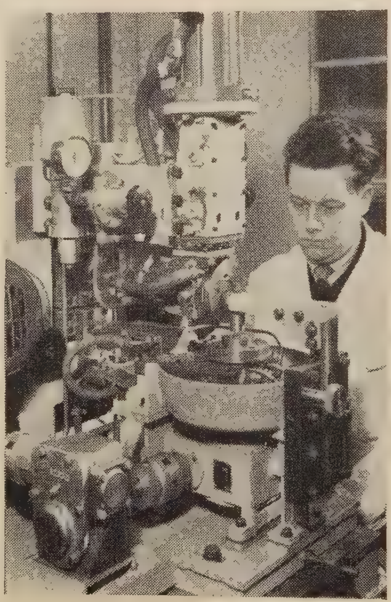
BENCH SEAM WELDER

The RAMC 10 bench seam welder developed by Sciaky Electric Welding Machines, Ltd., Falmouth Road (Trading Estate), Slough, Bucks., produces a pressure-tight joint on preformed stainless steel diaphragms and capsules used in the manufacture of scientific instruments and electrical control gear. It can weld thicknesses of mild and stainless steel from 0·010+0·010in to 0·036+0·036in and can be adjusted to suit diaphragm diameters from $1\frac{1}{4}$ to 6in. By using an infinitely variable hydraulic drive, welding speeds from $\frac{1}{2}$in to 4ft per min can be obtained. The bottom horizontal electrode jig assembly only is driven.

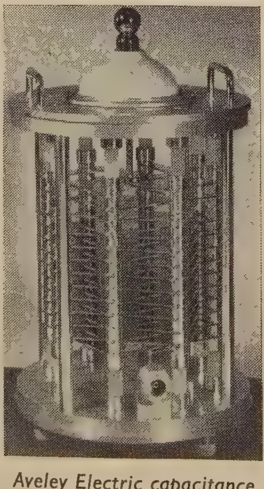
The operating sequence is electronically controlled by a Sciaky type DEK R/S fully synchronous control incorporating phase-shift heat control, half-cycle timing and ignitron contactors. Having located the two halves of the diaphragm on the bottom electrode jig, a clamp is applied. The operator then initiates the weld sequence, the top electrode applies the welding pressure, while the drive rotates the complete unit for welding. On completion, the welding head retracts, allowing the finished component to be removed. On $1\frac{1}{4}$in units a time cycle of 8 sec is attained. During the welding period flood water cooling is used to prevent distortion, a control being fitted to allow water to flow for this period only.



G.W.B. Furnaces type Z 600 A circuit-breaker



Sciaky bench seam welder

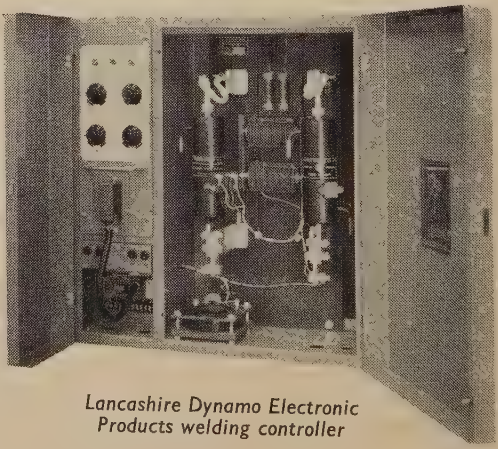


Aveley Electric capacitance standard

RESISTANCE WELDING CONTROL

A further extension to their series NEC.2 range of resistance welding control equipment is announced by Lancashire Dynamo Electronic Products, Ltd., Rugeley, Staffs. This comprises a "packaged" ignitron contactor and four-stage non-synchronous timer installation, designed predominantly for gun welder control but equally suitable for operation with normal pedestal type spot welding machines.

The timing unit provides non-synchronous control of the "squeeze," "weld," "hold" and "off" functions and includes facilities for single or

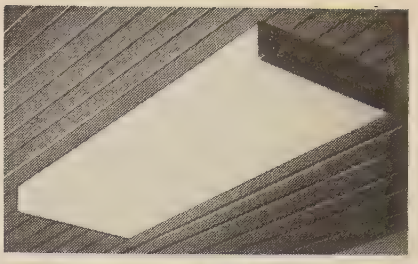


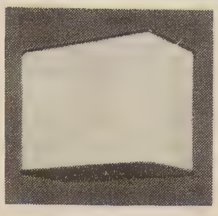
Lancashire Dynamo Electronic Products welding controller repetitive spot welding duty. Each of the timed intervals is independently adjustable, the time ranges provided being 2-60 cycles for the "squeeze," "hold" and "off" periods and 2-50 cycles (with "fine" control) for the "weld" period. The ignitron contactor unit is designed to accommodate ignitrons of the International size "A," "B" and "C" giving current switching capacities of approximately 100 to 580 A on a 50 per cent duty cycle.

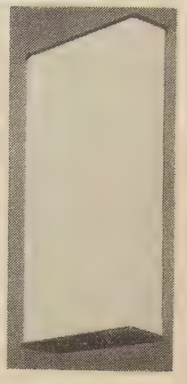
The complete assembly is housed in a wall-mounting cubicle, the approximate overall dimensions being 28in by 26in by 13in.

LIGHTING FITTINGS

A new range of shallow opal lighting fittings, known as the "SB" series, has been introduced by S.L.R. ELECTRIC, LTD., Welbeck Road, South Harrow, Middlesex. Each is constructed of "Perspex" with matt black metal end caps and designs are available for wall and ceiling mounting. A small wall fitting accommodates two 60 W tungsten lamps, a larger wall version has two 2ft 40 W fluorescent tubes, while a ceiling fitting is designed for three 4ft 40 W fluorescent tubes. Many other variations will be available shortly.







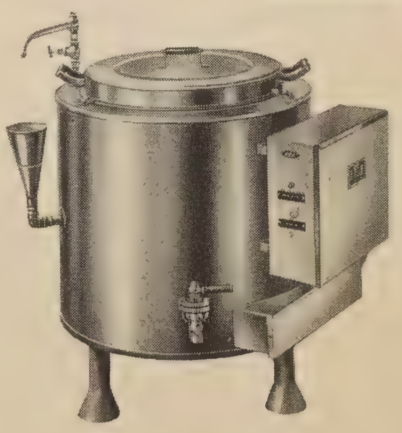
S.L.R. Electric "SB" series lighting fittings: small tungsten wall fitting (above), 2ft fluorescent wall fitting (right) and (top) 4ft fluorescent ceiling fitting

CATERING EQUIPMENT

Recent additions to the range of catering equipment manufactured by the GENERAL ELECTRIC CO., LTD., Lighting and Heating Group, Magnet House, Kingsway, London, W.C.2, include two new hotcupboards. One, model HO.115, has a 4ft service top containing four aluminium entrée dishes and three aluminium soup pots. Heat is supplied to these containers by two 800 W elements controlled by a separate thermostat. Sliding doors, mounted on roller bearings, are fitted with heat insulated handles. The second model, HO.116, is a 6ft hotcupboard heated by four 1,125 W elements. Both are constructed of heavy gauge sheet steel with stainless steel tops and finished in mottled grey stoved enamel with centre shelves in vitreous enamel. The price of the HO.115 (capacity 160 plates) is £108 10s and HO.116 (240 plates) costs £111.

Also announced are two new electric boiling pans which are available in 10, 20 and 30 gal capacities with either single or dual function. The largest has an additional lift-out pan which has locking clips to retain it in position. The outer cases and lids are constructed of stainless steel and adequate lagging is provided to ensure minimum heat loss. The prices of the single purpose pans, in their respective 10, 20 and 30 gal sizes, are £169, £212 and £244. The dual purpose pans cost £173, £225 and £263 respectively.

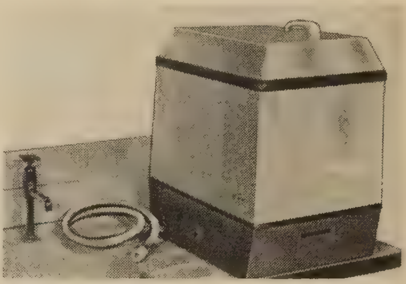
Re-designed coffee percolators are now available in 1 and 3 gal capacities capable of brewing 60 and 180 cups of coffee respectively. The elements are controlled by a three-heat rotary switch which provides intermediate heat so that the coffee may be kept warm until required. The prices are £35 (1 gal) and £44 5s (3 gal).



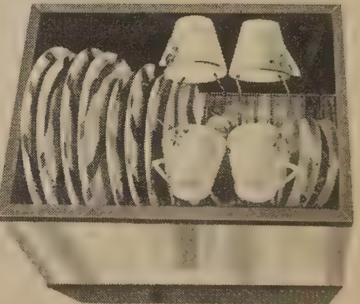
G.E.C. 10 gal dual purpose boiling pan

LOW-PRICED DISHWASHER

The new "G.P.R." Mk. I dishwasher now being marketed by G.P.R. DEVELOPMENTS, LTD., Lowesmoor Wharf, Worcester, heats the water; washes, drains and dries the contents; and switches itself off. The washing-up capacity is 20 pieces of crockery, including five cups, plus cutlery. It is very compact (18in wide by 13½in deep by 19½in high) and is designed to stand on the average draining board; connection is made to the water tap by a rubber hose. Construction is in heavy gauge aluminium throughout. A 2 kW thermostatically controlled heater is fitted as standard and the washing action is controlled by a recirculating pump. A pilot light indicates when the machine is in use. The total loading is 2·1 kW and models are available for use on 230-250 V a.c. only. The price, complete with 7ft of 3-core flexible and 4ft of filling hose, is £38 17s, including purchase tax.

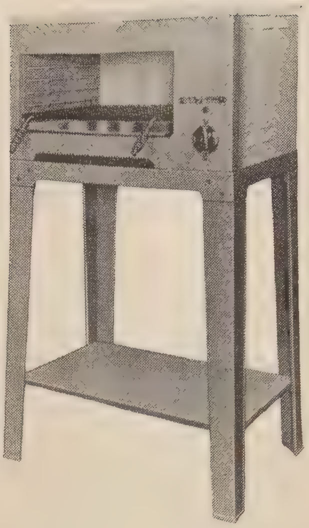


The "G.P.R." dishwasher and (below) a view of its interior (G.P.R. Developments, Ltd.)



DOMESTIC REFRIGERATOR

A new 6·8 cu ft refrigerator fitted with a thermostatically controlled compressor unit has been introduced by H.M.V. DOMESTIC APPLIANCES, LTD., 363, Oxford Street, London, W.1. It is fitted with two chromium plated wire shelves and a glass shelf which fits over a deep drawer for



Stott's type X.E.2 electric griller

Left: H.M.V. 6·8 cu ft refrigerator

vegetable and fruit storage. The full width freezer compartment provides storage space for approximately 28 lb of frozen food and also contains two ice trays (32 cubes). The door, fitted with a self-sealing magnetic gasket, opens inside the width of the refrigerator. On the standard model the door opens from left to right but models are available with right to left-hand door opening. It is fitted with an interior light and door shelves are provided. The finish is in white or cream stoved enamel with pale pink interior and the price, including purchase tax, is £72 9s.

HEAVY-DUTY GRILLER

The new type X.E.2 electric griller now being produced by JAMES STOTT & CO. (ENGINEERS), LTD., Vernon Works, Oldham, Lancs., has a loading of 6·6 kW and is designed for use on a 200/240 V a.c. single-phase supply. Control is by a three-heat rotary switch and a removable panel gives access to fuses, main terminals and element connections, etc. Front and side members are of heavy cast iron finished in blue mottled vitreous enamel, while back, top and sides are in sheet metal, finished in white vitreous enamel. The griller is 29in wide by 17⅜in high and 19in deep and is provided complete with brander, toasting rack and drip tray. A 36in high stand is also available.

WASTE DISPOSAL UNITS

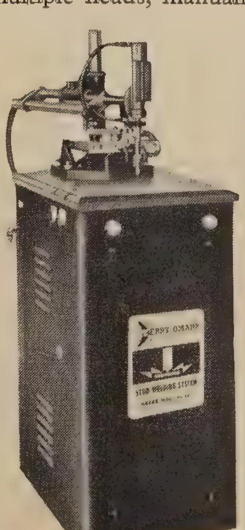
The latest addition to the range of "In-Sink-Erator" waste disposal units, marketed by WYNBOURNE - SATOBA EQUIPMENT, LTD., 90-96, City Road, London, E.C.1, is the "Developers" model. This machine is equipped with a built-in reversing action and is driven by a ⅓ h.p. capacitor start motor. The price, including purchase tax, is £42 2s 4d. The company's model 333, a single direction disposer, has been reduced in price from £42 2s 4d to £38 7s 5d, including tax. The price of the luxury model 77, equipped with an automatic reversing action, remains unchanged at £50 2s 3d, including tax.

Improvements announced for all the foregoing models include a four-bar rotor shredder made of "Damascan 10" for faster and more efficient grinding; a snap-on under-sink fitting for ease of installation; and a quick-connecting dishwasher fitting.

Capacitance Discharge Stud Welding

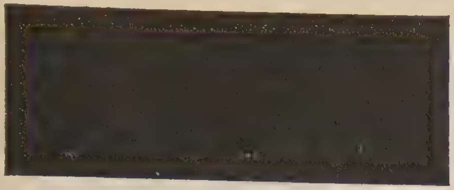
A MANUFACTURING licence for the "Gramweld" capacitance discharge, percussive, stud welding system has been received by KERRY'S (ULTRASONICS), LTD., Warton Road, London, E.15, from Omark Industries, Inc., of the U.S.A. This equipment is to be marketed under the trade name "Kerry-Omark" in the United Kingdom, Western Europe and certain Commonwealth countries. The weld is produced by discharging a large direct current at low voltage through a patented tip on the stud. The tip initiates an arc on contact with the workpiece. A current flow causes ionisation which melts the face of the stud and a similar area of the workpiece. The current flow is approximately 300,000 A/sq in with a voltage of under 150 V. The duration of arc is nominally 1 msec. Arc intensity for welding metals of different conductivity, thickness, and diameter of stud, is arranged by the design of stud tip length, diameter and configuration; by the adjustment of weld current available at the tip and by control of the speed at which the stud is brought into contact with the workpiece.

Machines for portable or fixed use available include models with single or multiple heads, manually operated or fully automatic, and with hopper feeds for the studs. The bench type welders are pneumatically operated, the "energy" discharge being controlled from either a floor operated valve or palm valves positioned on the machine. A motor generator supplies the potential to the weld storage capacitors. This machine is suitable for welding materials down to 0·020in thick. The machine may be arranged for fast repetitive welds and is capable of welding a stud every second. The capacity is up to ¼in diameter stud.



Kerry-Omark stud welder

The portable welders are electrically operated, the "energy" discharge being released by a compression spring operated from an electrically fired solenoid or by initial spring-loaded contact to the workpiece. Portable guns weighing only 1½ to 3¾ lb are used. The weld capacitors are charged via a transformer and full wave silicon rectifier circuit. These welders have facilities for polarity reversal to assist in welding thin metals or zinc coated steels.

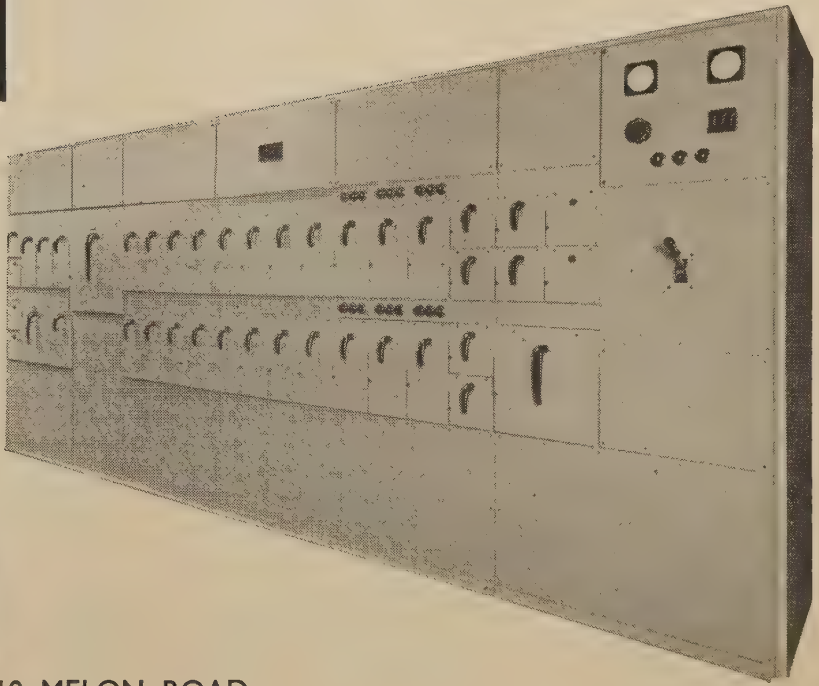


VARILECTRIC

cubicle

switchboards

Our cubicle and pedestal type switchboards are flexible in design, neat, compact, are front access for wiring and save money



Our Products include :—

LOW TENSION AIR CIRCUIT BREAKERS
CUBICLE AND PEDESTAL TYPE
BOARDS
MULTI-TIER MOTOR STARTER PANELS
RISING MAIN SYSTEMS
OVERHEAD BUSBARS
CABLE TRUNKING AND
SKIRTING DUCTING
DISTRIBUTION FUSEBOARDS
COMBINED DISTRIBUTION
FUSEBOARDS AND ISOLATORS

Send us your enquiries and problems

VARILECTRIC
LIMITED

10 MELON ROAD
LONDON, S.E.15
Telephone : RODney 6895/6/7
Telegrams and Cables : Varitric, London, S.E.15

The New Look in Lighting!

ASCOT X & ASCOT XX

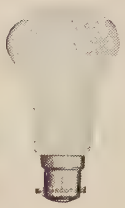
EACH LAMP A COMPLETE LIGHT FITTING IN ITSELF!

These new-shape lamps outdate all light-obscuring, dust-collecting globes. They save the cost of shades or globes and reduce time and money spent on cleaning. **Every Ascot X or XX lamp is coated internally with titanium di-oxide made to Patent No. 737861 for durability and extra brilliance without glare,** and guarantees 2,000 hours of the best diffused illumination. For domestic, commercial or public premises, in Entrance Halls, Canteens, Kitchens, Bathrooms, Workrooms, etc.

* *Prices: Ascot X (150 watts)* **12/6**, *inc. tax. Ascot XX (200 watts)* **17/1**, *inc. tax. 240 volts or 250 volts.*

WHG/L20

ANOTHER HIGHLIGHT OF THE EXTENSIVE ASCOT RANGE



DIPLOMAT
The new compact-shape lamp, with internal titanium di-oxide coating made to Patent No. 737861, for extra brilliance and durability.

FREE
Write now for a twelve-page catalogue in colour, giving the complete range of Ascot Lamps, fluorescent tubes and fittings for domestic and commercial use.

FIRST BRITISH-MADE LAMPS TO GIVE YOU TITANIUM DI-OXIDE BRILLIANCE

REGD TRADE MARK
ASCOT

ASCOT LAMPS AND LIGHTING LTD.
ARCOLA STREET, LONDON, E.8
CLISSOLD 5183/4/5/6

Depots at Manchester, Leeds, Birmingham, Glasgow and Edinburgh

A Radiation COMPANY

The accuracy needed for this triangular recorder spindle was thought to put it right out of the economical pressing field . . . until the experts from Briscoe came into the picture and made a first class job of pressing it out of ·022 soft steel strip in only three operations.

This was no happy chance — we are *experts* in designing and producing pressings, turned parts and even complete assemblies to your exact specification.

Don't let your Production Manager's hair turn white over producing that tricky component, call in BRISCOE right away — it will save time and money!

W. H. BRISCOE & CO. LTD.
WHARFDALE ROAD, TYSELEY, BIRMINGHAM, 11
Tel. ACOcks Green 1197 Grams: 'Brisk, Birmingham'

Aluminium Cable Manufacture

To meet the growing demand for aluminium power cables, a new factory has been erected at Jersey Marine, near Swansea, by the Aluminium Wire & Cable Co., Ltd. This factory, which has cost about £500,000, will specialise in the manufacture of Solidal p.v.c.-insulated power cables

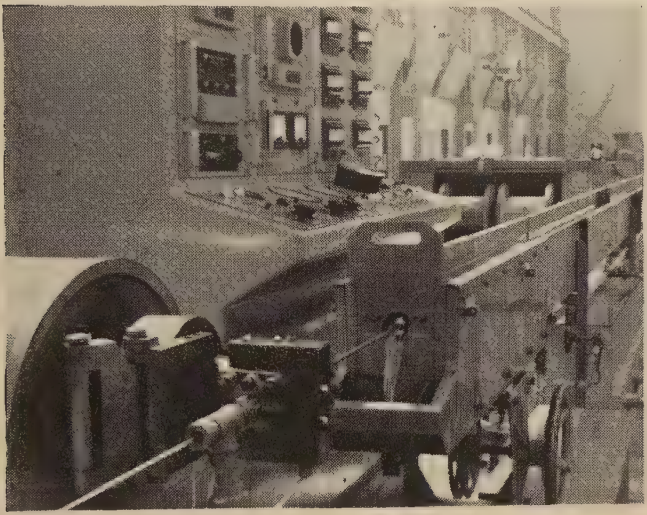
The design of Solidal cables provides a compact, lightweight cable of low cost without any sacrifice of accepted manufacturing standards. The use of solid segmental conductors eliminates the cost of stranding and reduces the core size as compared with normal multi-wire conductors. This reduction in core size together with the use of a concentric neutral conductor ensures that the size of the cable is kept to the minimum, with a resultant saving in the cost of the p.v.c. insulation and sheathing. Due to the ductility of annealed aluminium, the advantages of solid cores can be obtained without any loss of flexibility.

Apart from this, the main reason why Solidal cables compare favourably with cables having copper conductors lies in the low cost of aluminium compared with that of copper. For conductors having the same resistance, the cost of aluminium is less than half the cost in copper.

Plastic Extrusion Plant

Production of the conductors and armour wire is carried out at the company's Port Tennant works where the rod mill and wire drawing plants are situated. At the new Jersey Marine works the plastic extrusion plant incorporates an automatic diameter control coupled to the extruder drive, thus ensuring accurate control of the cable size. Concentricity of the insulant is continuously indicated to the operator by means of an oscilloscope mounted on the control panel. A continuously-operating spark tester indicates any faults that may exist in the plastic covering. Two take-up stands are provided, a single unit accommodating the larger cables, while a smaller dual unit with automatic change-over accommodates the smaller sizes.

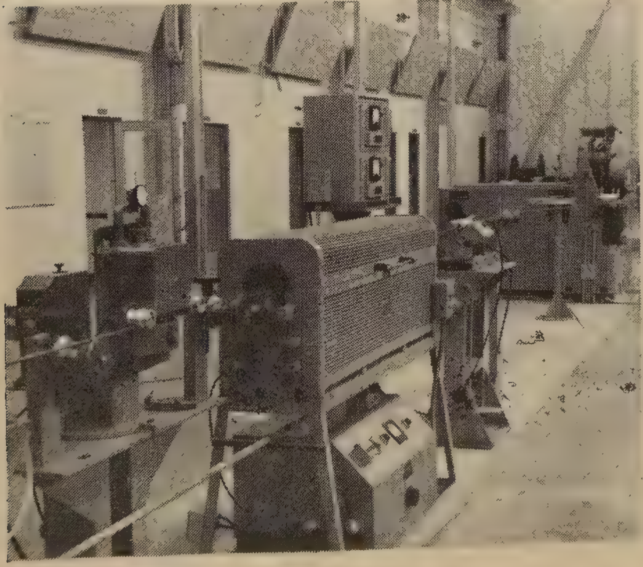
A combined armouring and laying-up machine performs, simultaneously, the laying up of the cores and the application of the bedding tapes, neutral/armour strips, aluminium foil and barium chromate tapes to the multi-core Solidal cable. A 30-bobbin armouring machine

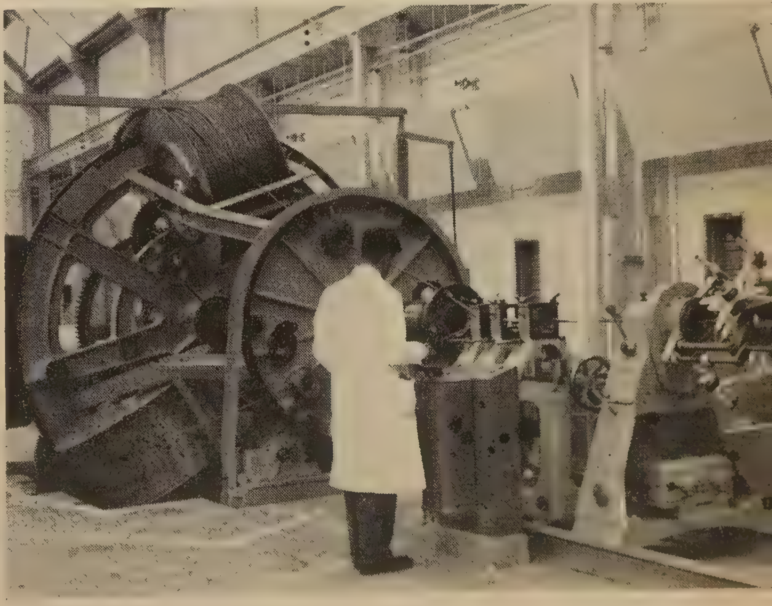


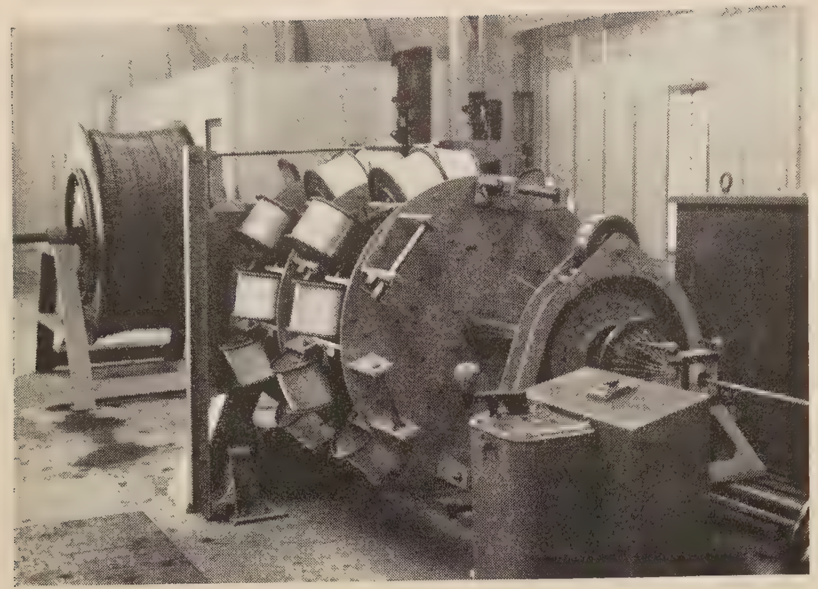
Left: General view of 4½in extruder showing central control console

Below left: Section of the extruder line showing diameter control, spark tester and concentricity gauge

Below: Section of the combined laying-up and armouring machine, showing the laying-up of the three cores and application of the p.v.c. bedding tapes on 3-core concentric neutral Solidal cable







Application of armour wires to single-core concentric neutral Solidal cable

applies the neutral/armour wires to the single-core concentric neutral cables.

The plant layout is designed on the flow line principle and therefore the movement of the cable during production is kept to the minimum so that the maximum advantage is taken of the available floor space. The laboratories at both the Port Tennant and Jersey Marine works of the company ensure that there is accurate and close control of the cable at each stage in the manufacturing process.

The new plant enables the company, who are well known as suppliers of aluminium wire and bare overhead conductors, to offer a complete range of Solidal p.v.c.-insulated power cables, covering three-core concentric neutral/armour cables from 0·04 to 0·50 sq in nominal aluminium area and single-core concentric neutral/armour cables of 0·025, 0·04 and 0·06 sq in nominal aluminium area.

A comprehensive range of p.v.c.-covered overhead conductors is also available with aluminium conductor steel reinforced (a.c.s.r.) and Compactal a.c.s.r. all-aluminium (A-A) and Compactal A-A and Silmalec (aluminium alloy) cores.

As is often the case, new capacity has brought new uses for the company's products and as a result of development in conjunction with the Admiralty, the Aluminium Wire & Cable Co. have produced a p.v.c.-covered aluminium alloy wire rope which is already being installed in many of Her Majesty's ships as guard wires.

More Socket-Outlets Recommended

IN a report to the Ministry of Housing by a sub-committee appointed by the Central Housing Advisory Committee, more socket-outlets are recommended for houses. According to the report ("Homes for Today and Tomorrow," H.M. Stationery Office, price 4s) the general practice at present is to provide the minimum number of socket-outlets for which the Electricity Boards will install the supply cable free in newly-developed areas where they are empowered to make a charge. For the average house the number is stated to be six.

The conclusion of a survey carried out by the Building Research Station in 1959 was that in a house designed for five persons, at least 15 socket-outlets were required to meet reasonable everyday needs. This conclusion is endorsed by the sub-committee, which now recommends, in view of the rise in consumer expenditure on electrical goods, that at least 15 socket-outlets should be provided and, whenever it can be afforded, 20 socket-outlets, some of which could be doubles. The sub-committee also emphasises that it is desirable to arrange wiring so that it can conveniently service future outlets and, furthermore, that research is needed into initial installation methods which will enable future outlets to be added at minimum cost and disturbance.

The sub-committee stresses the importance of the position of socket-outlets. In many dwellings it was found that instead of being put in places where they were most likely to be needed, the main consideration had obviously been to save wiring.

The provision of a higher standard of heating in the home comes high in the list of improvements. Better heating is the key to the design of the home, states the report, and the demand for it is strong. It is recommended that the minimum provision should be an installation capable of heating working areas (e.g. kitchen) to 55°F and the living room and dining area to 65°F, when the outside temperature is 30°F. Wherever family requirements demand it, a more expensive installation capable of heating the bedrooms as well to 65°F will represent greater value for money. The report goes on to say that where the minimum installation is provided or something capable of heating more of the house, there is a clear trend of demand towards systems which are clean and entail little or no work.

The general characteristics of fuels and heating systems are dealt with in the report, which also includes a study of the cost of solid fuel, oil, gas, and electrical thermal storage systems.

CHRISTMAS LECTURES

A Christmas lecture for young people, with demonstrations, entitled "Joining the Modern Way," is to be held at the Institute of Welding, 54, Prince's Gate, Exhibition Road, South Kensington, S.W.7, on 4th January at 11 a.m. Admission is by ticket only, obtainable from the Institute.

A series of six Christmas lectures on "Electricity" is to be given by Sir Lawrence Bragg at the Royal Institution, Albemarle Street, London, W.1, between 28th December and 9th January. The lectures are specially adapted for a juvenile audience. The subscriptions are: Juveniles, 10-17, £1; adults (non-members), £2.

Electrolytic Tinning Line

HIGH-SPEED PRODUCTION AT EBBW VALE WORKS

THE new electrolytic tinning line at the Ebbw Vale works of Richard Thomas & Baldwins, Ltd., is designed to operate at up to 1,500ft/min, and it incorporates several novel features. These include a production analyser, which prints out the total footages of off-gauge sheet and faulty coatings after each coil is completed and a data recorder which produces a tape indicating the position of reject material in each coil, for subsequent " play-back " on the cut-up lines.

Other features of the line are the unusually high looping tower, which rises 25ft above a pit 80ft deep, giving an ample reservoir of strip to keep the line operating while a new coil is welded to the tail of the previous one, and the placing of the electrolyte tanks well clear of ground level. Accurate shearing is impossible at the speeds at which the line can work and so two cut-up lines are provided to deal with its output.

The line can give tin coatings as low as a ¼ lb of tin per box of tinplate to 1 lb per box, and it can give differential coatings—i.e. a thickness of coating on one side of the plate different from that on the other side. It can coat plate of thicknesses from 0·168 to 0·56 mm and can supply sheets up to a maximum size of 37½ by 37in. It also makes available tinplate in coil form.

The line is designed for an annual output of six million basis boxes (a box represents 217 sq ft) of tinplate in coils and sheets, and consists of one coil preparation line, one Ferrostan electrolytic tinning line, two tinplate cut-up lines, and one inspection and assorting line. With the exception of the civil engineering works and the supply of services such as power, steam, water, etc., the project was engineered by the Head Wrightson Machine Co., Ltd., with Ebbw Vale Engineering Departments, and designed by them in association with the Aenta Standard Division of the Blaw Knox Co., Pittsburg.

The coil preparation line incorporates improved designs of pay-off and tension reels, seam welder and edge trimmer, and with a top speed of 4,000ft/min has a rated output of 300 tons per shift. Coils of steel strip from the temper mill are edge trimmed and built up into 36,000 lb coils for processing through the electrolytic tinning line. Off-gauge strip can be cut out on the line and re-coiled on a reject tension reel. Finished coils are transferred from the coilers on to a horizontal conveyor for temporary storage and weighing on a machine incorporated in the conveyor.

Ferrostan Electrolytic Tinning Line

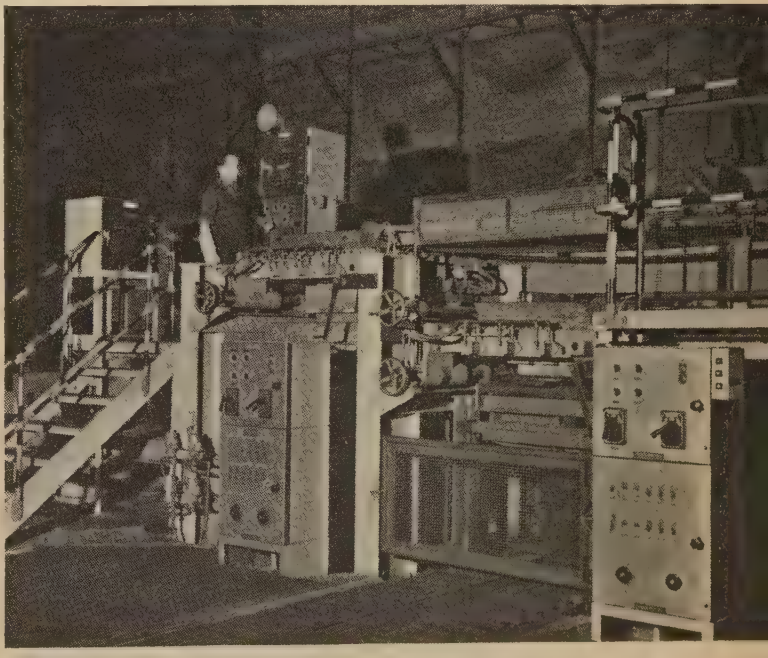
Fundamentally, the Ferrostan process of the United States Steel Corporation has changed little since the No. 1 line was installed at Ebbw Vale in 1947. To attain and maintain the high rate of production of the new line, speeds up to 1,500ft/min are necessary, bringing problems not hitherto encountered on Ferrostan lines. Unscheduled stoppages for maintenance and other down-time must be kept to the absolute minimum and this has entailed designing the equipment to facilitate the quick changing of rolls.

To keep the plating current density within the range 150 to 300 A/sq ft special controls for the sequential switching of the plating rectifiers have been incorporated.

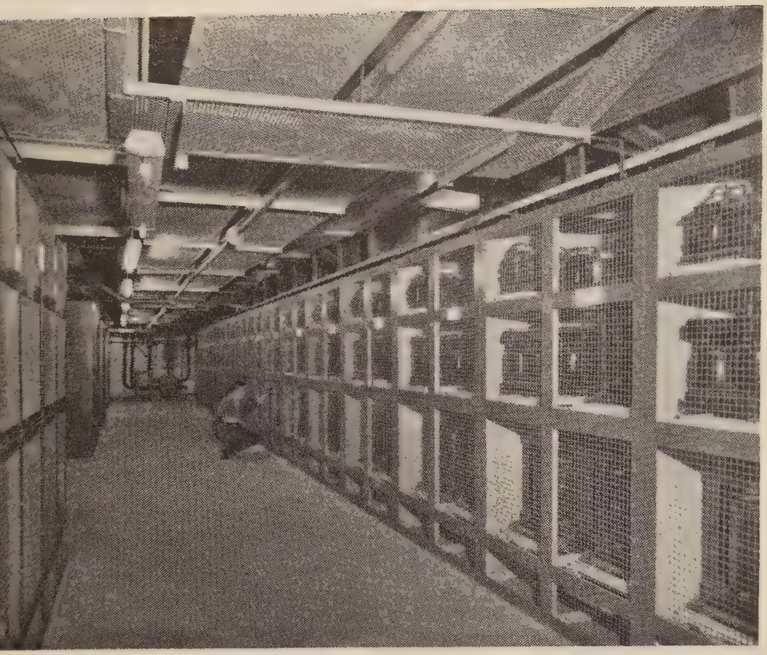
The d.c. and a.c. line drives and their associated control equipment were manufactured and installed by the General Electric Co., Ltd. The d.c. drives comprise some 108 motors whose ratings range from 5 to 170 h.p. These motors are used for propelling the strip through the line and are supplied from eight d.c. generators located on two main m.g. sets with 2·2 kV squirrel-cage driving motors and two booster and exciter sets, with 440 V squirrel-cage driving motors. The generators and boosters are controlled by means of 400 c/s magnetic amplifiers to give accurate control of strip speed and tension in all parts of the line. The 55 a.c. auxiliary drives range between 1 and 75 h.p. and are used mainly for driving various pumps and fans for circulating the plating electrolyte and drying the strip after plating. Controls were also supplied for operation of the large number of solenoid valves which are always necessary on such a line.

At the beginning of the process, coils of cold reduced mild steel strip are transferred from the coil carriage to one of the two pay-off reel mandrels. Strip is inched from the pay-off reel via a.c.-driven feed pinch rolls to an air-operated double-cut shear where the leading edge of the strip is trimmed ready for welding to the tail end of the strip which is already in the line and has been previously trimmed at the welder shear.

The two ends of the strip are then positioned at the welder and seam welded. The strip then passes through the entry-pulling bridle which, together with the pay-off reel, is accelerated to top speed to fill the three looping



One of the two cut-up lines which handle material from the electrolytic tinning line

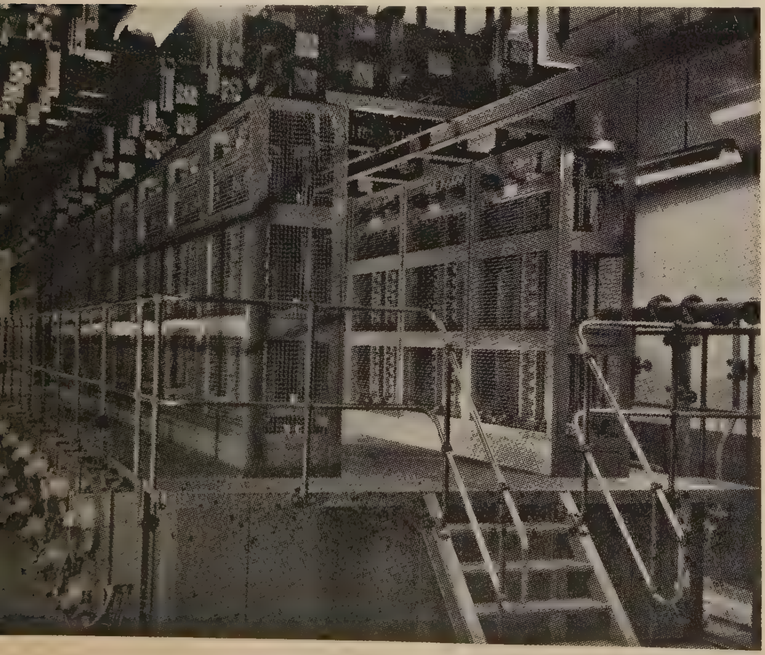


Transductor cubicles associated with the plating rectifiers

pits with strip. After passing out of the pulling bridge, the strip runs through four pinch rolls at the top of a tower and forms three loops 80ft deep. The height of these loops is controlled by means of four infra-red photocells in each pit.

The looping area acts as a reserve of strip to feed the processing section so that it can run continuously whilst the entry section is stopped to change coils on the pay-off reels. Strip passes out of the looping pits into a four-roll drag bridle, which controls the back tension in the processing section.

The processing section consists of about 63 dry rolls and about 22 wet rolls. Each roll is individually driven by a 5 h.p. geared motor unit. The dry rolls are current controlled so that they each take a proportion of the load. The wet rolls have an over-riding speed control so that when a liquid film forms between the roll and the strip at high speed, the rolls remain at strip speed, even though the load is removed. This control prevents skidding and marking of the strip when the line decelerates again, since the surface finish of the strip is of prime importance. The processing section is divided up into nine groups as follows: cleaning, pickling, scrubber, plating and drag-out, pannier printer, melted coating, chemical treatment, electrostatic emulsion oilers and dryers and, finally, inspection.



Plating rectifiers and busbars feeding the plating tanks

The strip is then pulled out of the processing section by a four-roll master drive bridle unit and it then travels through a pinch roll unit and on to one of the two tension reel mandrels, where the finished product is tension coiled at full speed. When one reel is nearly full, the empty mandrel of the other reel is run up to shearing speed (500ft/min) and the line is run down to this speed. A snip shear is operated and the full reel is stopped. The leading edge of the sheared strip is pushed through the shear gate by the pinch roll, guided on to the running empty mandrel and the first few turns are held tight on the mandrel by means of a belt wrapper. After the coil is started, the wrapper is withdrawn and the line is accelerated to top speed again. This system enables the tinning line to run at full speed most of the time and feed coils of tinned strip to two shearing lines which, necessarily, have to run at a lower speed, due to the limitations of the flying shear. The tinning line can, however, run at a lower speed and feed strip directly into one of the shearing lines by by-passing the tension reels.

The complete electrical equipment for the coil preparation line, the conduction reflow equipment, the two cut-up lines and their associated single-sheet classification equipment and the auxiliary electronic equipments for production analysis and control were supplied by the English Electric Co., Ltd.

The electrolytic process leaves the tinplate with a matt finish and usually the coating is melted and immediately quenched to improve the quality. This is carried out by passing an alternating current of several thousand ampères through the strip as it passes between two conductor rolls. The signal for controlling the reflow current is derived from a speed transmitter and is fed, via magnetic amplifiers, to the d.c. windings of saturable reactors. Photoelectric cells are mounted on the reflow tower to trim the control signal.

As tinplate can be produced at almost twice the speed of subsequent operations, two almost identical cut-up lines are provided. If required, however, No. 1 line can be used as an extension of the tinning line. The cut sheets are sorted into four piles depending on whether they are prime, off-gauge, pin-holed or marred by surface defects. The various conveyors on this section of the lines are Ward-Leonard controlled so that their speeds can be individually adjusted, first to form a gap between sheets, and then an overlap to facilitate piling.

Each line incorporates equipment for the automatic classification of the cut sheets. The monitoring instruments must operate on the continuous strip, and visual inspection is also carried out before shearing. The fault signals are synchronised with the material, using digital logic techniques. After the shear the signals are related to individual sheets so that only faulty sheets are rejected. The circuitry is fully transistorised and built-in checking facilities can change over to a healthy circuit if necessary.

The most convenient place for visual inspection is on the tinning line itself. Hence, when the cut-up lines are operating as separate units it is necessary to relate the fault signals to the strip when it is uncoiled for cutting up. This is done by means of a paper tape in which holes are punched for rejected increments of strip. To avoid cumulative error, these increments are related to half-turns of the coil. The tape is terminated with the operation of the snip shear and is then transferred with its coil to the cut-up line. It is then put through a tape reader in the reverse direction and the signals are fed into the classifier logics.

When tinplate is sold in coil form it is desirable that a record be available of the amount of prime and reject material in each coil. This record is produced in tabulated form by the production analyser which uses similar techniques to the single-sheet classifier.

A small inspection line, driven by a.c. motors, through variable-speed gearboxes, is used for the sorting of mixed piles of sheets. This line presents the sheets one at a time and they can be divided into three piles as required. A counter, with digital read-out, is provided for each pile of sheets.

The germanium rectifier equipment to provide the 215,000 A d.c. for the preparation and tin plating of the steel strip was supplied by the Westinghouse Brake & Signal Co., Ltd. As the tin deposit has to be maintained exactly constant at a preset value in spite of variations of the strip speed, the output current of the plating rectifiers is exactly controlled in proportion to the speed of the line. This is carried out by a static servo control system which achieves the required proportionality with an accuracy of better than ±1 per cent.

The calculating network, which converts the operator's instructions for a particular tin coating to an electrical signal fed to the rectifiers, is housed with the other rectifier controls in a suite of panels adjacent to the line itself. The rectifiers are in a room adjacent to the line on the same floor level, and have been designed to occupy the same length as the section of the line they feed, and thus minimise the copper busbar run.

TRANSFORMER LAMINATION PRODUCTION

A NEW automatic transformer core plate cutting machine has recently been installed in the distribution transformer department of Ferranti, Ltd., at West Gorton, Manchester. At this factory, transformers of up to 1,500 kVA, employing lock-wound, mitred and conventional cores, are produced by flow-line methods.

The feed line was designed and manufactured by Humphris & Sons, Ltd., of Poole. It comprises a control cabinet; loop control unit, incorporating a photo-electric cell; a decoiler; a loop support unit, fitted with a micro switch to control a no-loop condition; a feeding and measuring machine incorporating pinch rolls, measuring rollers, and entry and exit guides; a Humphris CP25 Pressmaster open-front power press, complete with an oscillating mitre cutting tool; and a run-out table and stacking unit for the finished transformer laminations. Air flotation is used in the oscillating press tool to assist free angular movement through 90° giving alternate 45° mitre cuts. For the feed line an accurate position control servo system has been developed jointly by Humphris & Sons, Ltd., and Laurence, Scott & Electromotors, Ltd.

Automatic Feeding and Cutting

The decoiler consists of a spindle-mounted mandrel driven by a variable-speed a.c. motor through a reduction gear and electromagnetic clutch with an electromagnetic brake at the other end to control over-run. Coils up to 2,800 lb weight and 10in in width can be accommodated. The material is then inched from the coil and threaded beneath the "no-loop" control arm into the feeding machine pinch rollers and the side guides set to suit the material width. The motorised reel is then switched to automatic operation and the maximum reserve loop of material formed. The reel stops automatically when the loop actuates the photo-electric cell on the control unit. Following this, the measuring rollers of the feeding machine are engaged, and the required length of strip selected on the control panel.

The material is drawn from the loop by the 4in diameter feed rolls which are driven by a 3 h.p. d.c. motor and passed through a pair of measuring rollers before being fed into the cropping machine. This d.c. motor forms part of a Ward-Leonard system; a d.c. amplifier provides the field for a split field generator driven by an a.c. induction motor. The generator then feeds the d.c. motor armature—the field of which is fed from a separate d.c. source—and the motor drives the rollers of the feeding machine through a step-down gearbox giving an average feed rate of 120ft/min, with a maximum of 200ft/min. As the material proceeds to the cropping machine, it passes between a pair of 2½in diameter measuring rollers which drive a two-lift cam through a reduction gearbox and reversing clutches. The lifts on the cam rotate a Magslip, the lifts being so designed that at some point zero output is obtained from the Magslip rotor. The output from the rotor is then fed into a phase-sensitive rectifier. Thus, rotation of the cam about this point will give a positive or negative output from the phase-sensitive rectifier, and as this is fed into the d.c. amplifier, the system forms an accurate position control servo.

Once the d.c. motor is running, it continues to do so until the cam rotates the Magslip to give zero output. The cropping tool is then operated, the clutches reverse and the cam is driven in the opposite direction when the sheet or strip moves forward. The sheet will move forward until the other lift rotates the Magslip to give zero output. The distance between the lifts can be adjusted to give different lengths of sheet between cuts. Provision is also made in the control panel for fine adjustment to be made in the length of material to be cut. After cropping, the core laminations are carried forward to a stacking unit by a continuously-driven conveyor belt.

Financial Section

STOCKS and SHARES

MOST companies will be ruling off their annual accounts in a fortnight's time, and on this occasion the industrial markets of the Stock Exchange are looking forward with some apprehension to the profits statements and dividend declarations to follow within a month or two. From many sides of industry, including branches of heavy electrical engineering and domestic equipment, there have already been clear warnings, in interim reports, about the extent to which the earnings of 1961 will have been affected by the narrowing of profit margins and the workings of the credit squeeze. Some fresh consternation was caused last week by the size of the recessions disclosed in the principal steel manufacturers' annual profits statements.

Price Changes

Shares of the principal electrical groups continued to reflect anxiety over final dividend prospects. Both English Electric and General Electric lost another 1s to the common level of 24s, a factor in the latter case being the reduction in profits reported by Radio and Allied Holdings, now a subsidiary of G.E.C. Crompton Parkinson, however, were well supported up to 12s 9d. There were mixed changes in radio and domestic equipment issues. Hoover and British Electronic Industries remained depressed, but Dimplex and Berry's Electric retained all their buoyancy. Decca " A " moved erratically between 67s and 71s 3d, and Bulpitts rose 2s 6d, to 18s 6d, on a revival of unsubstantiated " bid " rumours. Minor losses appeared fairly frequently in the lists, but notable resistance was displayed by Aerialite, Alwyn, Eleco and Electrical Apparatus. The last-named were quoted " ex " the 100 per cent scrip issue.

Brook Motors Results

On the strength of the excellent figures in the company's preliminary statement on the results for the year ended in September, the 10s shares of Brook Motors were raised to 55s, their highest quotation of the year. With profits (before tax) up by as much as 44 per cent, it was thought in the market that the decision to hold the dividend at last year's rate of 25 per cent might have been made out of deference to the Chancellor's wishes on the subject, for the payment appears to involve the distribution of not much more than a third of the net surplus available. Shareholders are however to receive a 10 per cent scrip issue. The present yield of 4½ per cent on the shares would rise to 5 per cent if the same rate were paid next time on capital increased by the issue.

Duport Dividends

Following several years of substantial progress, trading profits of the Duport

Price Changes in

Company or Board	Nom. Value	Middle price 11th Dec.	Week's Rise or Fall	Dividend		Yield %			1961	
				Previous	Last	£	s	d	Highest	Lowest
Gilt-edged Stocks										
Brit. Elec. 1968/73	100	74½		3	3	4	0	6	75½	70½
Brit. Elec. 1974/77	100	69		3	3	4	7	0	70½	64½
Brit. Elec. 1976/79	100	70	−½	3½	3½	5	0	0	73½	67
Brit. Elec. 1974/79	100	79		4¼	4¼	5	7	6	82	75
Brit. Elec. 1967/69	100	91½		4½	4½	4	18	3	92	86
Overseas Electric Supply										
Calcutta Elec.	£1	21/3		7†	7½†	11	11	0	22/3	20/6
East African Power	£1	12/-		8	10	16	13	3	15/-	12/-
Nigerian Elec.	£1	18/-	−6d	10	14	15	11	3	19/9	15/6
Perak Hydro-Elec.	£1	21/9		15	15	13	16	0	23/6	17/6
Electrical Shares										
Aberdare Holdings	5/-	12/3		17½	12·3‡*	5	0	6	12/3	10/9
Aerialite	1/-	5/-	+3d	54	40	8	0	0	8/-	4/3
Allen, W. H.	£1	25/-		14	10*	8	0	0	42/6	25/-
Allied Insulators	5/-	8/3		20	10*	6	1	3	10/-	8/-
Alwyn Holdings	5/-	23/9	+1/9	12½	15*	3	3	3	23/9	16/6
Anglo-Portuguese Tel.	£1	19/3	−3d	9	9	9	7	0	25/-	18/9
Arcolectric	1/-	5/6		15	15	2	14	6	6/-	3/9
Astaron Electronics	5/-	24/6	−9d	15	15	—			30/-	17/-
Assoc. Elec. Ind.	£1	29/3	−9d	15	15	10	5	0	48/6	29/9
Babcock & Wilcox	£1	21/3		9	9	—			36/6	19/-
Bakelite	10/-	37/6	−2/6	17½	17½*	4	13	3	60/-	40/-
Baldwin, H. J.	2/-	1/-		10	Nil	—			1/9	1/-
Berry's Electric	5/-	64/3	+6d	30	33⅓*	2	12	0	64/6	37/-
Bowthorpe Holdings	2/-	7/6		18½	22	5	17	6	10/3	7/6
Brit. Elec. Resistance	2/-	7/3		17½	17½*	4	16	6	8/9	6/6
Brit. Elec. Traction:										
Def. Ord. " A "	5/-	53/-	−6d	40	50	4	14	3	57/6	41/9
British Electronic Ind.	5/-	10/3	−1/-	—	15	7	6	3	15/3	8/9
B.I. Callender's	£1	56/-	−9d	13½	13½	4	16	6	62/3	49/6
B.I. Callender's 6% Pref. ...	£1	17/-		6	6	7	1	3	18/3	16/6
British Thermostat	5/-	33/-		20	27½	4	3	3	40/-	28/-
Brook Motors	10/-	55/-	+1/3	25	25	4	11	0	55/-	47/-
Bruce Peebles	10/-	15/-		10	Nil	—			21/-	13/3
Bulgin, A. F.	1/-	11/6	−3d	55	40*	3	9	6	13/3	7/9
Bulpitts	5/-	18/6	+2/6	15	16¼	4	7	9	27/6	16/-
Burco Dean	5/-	5/9		18	15	—			11/9	5/9
Cable & Wireless	5/-	17/-		10	10*‡	2	18	9	19/9	12/6
Cambridge Instruments ...	5/-	30/-	+1/-	12½†	22	3	13	3	38/6	29/-
Chloride El. Storage " A " ...	£1	75/9	−6d	17½	20	5	5	6	91/-	72/-
Clarke Chapman	£1	36/-	−1/6	13¾	13¾	7	12	9	54/-	36/-
Clarke, T.	2/-	4/-		16	16	5	6	9*	5/3	3/6
Combined Elec. Mfrs.	4/-	7/3		—	12½	6	18	0	10/-	6/9
Contactor Switchgear ...	5/-	14/3		14	14	4	18	3	16/-	12/6
Crabtree	10/-	25/-		12½	12½	5	0	0	33/9	23/-
Crompton Parkinson	5/-	12/9	+3d	12½	12½	4	18	0	14/6	11/3
De La Rue	10/-	51/3	−2/6	22½	22½*	4	7	9	70/-	44/6
Decca " A "	10/-	68/9	+1/3	23⅓	23⅓	3	7	9	71/3	52/3
Desoutter	5/-	60/-	+1/3	30	35	2	18	3	68/9	49/-
Dewhurst	2/-	5/9		20	20	3	9	6*	6/6	3/9
Dictograph	2/-	10/9		20	20	3	14	6	13/-	8/6
Dimplex	5/-	51/3	+2/6	30	35*	2	1	0*	55/6	28/3
Dubilier Condenser	1/-	2/3		30	15*	6	13	3	3/-	2/-
Duport	5/-	9/-	−3d	20	13⅓*	7	8	0	17/-	9/-
E.M.I.	10/-	44/-	+9d	17½	17½	3	19	6	51/3	35/3
Eleco	2/-	10/6	+3d	20	20*‡	3	16	3	10/6	4/3
Electrical Apparatus	5/-	11/6x.c.	+6d	20	22	4	15	9*	11/6	8/6
Electrical Components	5/-	9/-		11½	12½	6	19	0	9/9	7/9
Elec. Construction	£1	19/-	−1/-	9	5	5	5	3	39/-	19/-
Elliott-Automation	5/-	40/-		9·3	13	1	12	6	40/-	25/6
Enfield Rolling Mills	£1	36/3	+6d	15	15	8	5	6	51/6	35/6

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

Group contracted by about a quarter in 1960–61, and although the dividend for this period is being effectively maintained at 13½ per cent the chairman warned shareholders in the annual report that some reduction in the next distribution might be necessary unless there were an early improvement in trading conditions. In most of the divisions turnover and profits were being affected by the recession in the steel, motor and consumer durable industries. Results of the electrical divisions improved last year, but were still unsatisfactory. There has been a sharp subsequent fall in the price of the 5s shares to 9s and the yield has gone out to nearly 7½ per cent as a result of the dividend uncertainty and the prospect of a capital issue when times are more propitious.

Electrical Investments

Company or Board	Nom. Value	Middle price 11th Dec.	Week's Rise or Fall	Dividend		Yield %			1961	
				Previous	Last				Highest	Lowest
Electrical Shares—continued						£	s	d		
English Electric	£1	24/-	—1/-	10	10	8	6	9	40/9	24/-
English Electric 3¾% Pref. ...	£1	10/9		3¾	3¾	7	0	0	11/9	9/9
Ever Ready	5/-	43/-		20	22½	2	12	3	43/-	31/6
Falk Stadelmann	£1	23/6		7½	8¾	7	9	0	26/-	21/9
G.E.C.	£1	24/-	—1/-	10	10	8	6	9	39/6	24/3
G.E.C. 6½% Pref.	£1	17/-		6½	6½	7	13	0	19/3	16/6
General Cables	5/-	4/9		15	Nil		—		6/3	4/9
G.H.P. Group	£1	19/6	+6d	6	7‡	7	3	6	24/6	17/-
Goblin (B.V.C.)	5/-	4/3	—3d	12½	10	11	15	3	8/6	4/3
Hackbridge Holdings	5/-	4/6		20	10*	11	2	0	6/9	4/6
Harland Engineering	5/-	13/-		16	16	5	18	6	19/-	12/-
Head Wrightson	5/-	19/3	—1/3	14	16	4	3	0	30/-	19/3
Heatrae	2/-	16/9		12½	25	2	19	9	19/-	12/6
Holophane	5/-	16/-	+3d	30	30	9	7	6	20/6	14/6
Hoover	5/-	43/-	—2/6	90	45*	5	4	9	55/6	37/6
Hunt, A. H.	4/-	19/3		20	20	4	3	0	25/9	17/6
Intl. Combustion	5/-	25/-	—6d	20	30	6	0	0	33/9	22/9
Intl. Computers & T.	£1	98/9	+1/9	10	11¼	2	5	6	107/-	59/-
Johnson & Phillips	£1	18/9	—9d	Nil	5	5	6	9	24/-	17/6
Kenwood Mfg.	1/-	3/3		—	12½	3	17	0	6/-	3/3
Laurence Scott	5/-	15/6	+6d	15	15	4	16	9	18/9	14/3
Lister, R. A.	£1	54/-	—1/-	14	14	5	3	9	56/9	45/6
Lucas, J.	£1	56/3		13¾	13¾	4	17	9	71/6	50/-
Marryat & Scott	2/-	16/9		27½	32½	3	17	6	18/6	13/9
Mather & Platt	£1	35/9	—1/9	11	11	6	3	0	51/6	35/9
Metal Industries	£1	52/-	—1/-	15	15	5	15	6	66/6	46/3
Midland Elec. Mfg.	£1	55/-	—1/3	12	12	4	7	3	67/6	52/6
Murex	£1	40/-		20	13*	6	10	0	51/6	37/6
Newman Ind.	2/-	7/-		12½	15	4	5	9	7/6	5/-
Oldham & Son	1/-	2/6		17½	17½*	7	0	0	3/-	2/3
Parmiter, Hope & S.	1/-	2/-		12½	20	10	0	0	2/5	1/6
Parsons, C. A.	£1	51/3	—9d	9⅜	12½	4	17	6	72/6	46/9
Philips' Lamps	Fl.10	197/6		16	16*	1	12	6	£13¼	£9¾
Plessey	10/-	44/9	—1/3	17	15*‡	3	7	0	46/-	35/3
Pullin Group	2/-	10/3		25	25	4	17	6	15/-	10/-
Pyrotenax	5/-	45/-		40	45	3	15	0*	48/9	34/9
Radiation	£1	24/3		12	10	8	5	0	37/6	22/6
Reliance-Clifton	5/-	19/9		15	20	3	7	0*	22/-	14/9
Reyrolle	£1	43/9	+1/9	17½	9¾*	4	9	0	51/6	36/6
Richardsons Westgarth	10/-	3/9		8⅓	Nil		—		8/3	3/6
Sanders, W. H.	2/-	18/-		17½	17½‡	1	18	9	28/3	14/-
Sangamo Weston	10/-	23/9		13⅓	10‡*	4	4	3	25/9	18/9
Scott, James	5/-	31/-		25	27½		—		32/-	25/6
Simon Engineering	5/-	31/-	—1/-	—	27½	4	8	9	43/9	28/-
Smith (England), S.	4/-	15/6		20	20	5	3	3	23/9	13/9
Southern Areas	£1	16/-		5	6	7	10	0	23/-	14/6
Strand Elec.	5/-	18/3		14·6	20	5	9	6	20/-	12/3
Sturtevant	5/-	10/3	+6d	15†	13†	10	6	0	18/6	8/9
Sun Elec.	5/-	16/6		18½	18½	5	12	0	17/6	14/3
T.C.C.	10/-	41/9	+6d	35	22½*	5	7	9	43/9	40/-
Telephone Rentals	5/-	27/-		15	15‡*	2	15	6	29/6	18/6
Thompson (John)	5/-	10/9	—3d	20	5		—		16/9	10/9
Thorn Elec.	5/-	62/6	—1/3	25	25	2	0	0	63/9	44/6
Thornycroft	4/-	4/-		6	—		—		7/-	4/3
Tube Investments...	£1	58/9	—4/3	—	14	4	15	3	85/-	54/-
Ultra Electric	5/-	20/6	—1/6	20	25		—		31/3	12/6
Walsall Conduits	4/-	10/9		15	15	5	11	6	15/-	9/9
Ward & Goldstone	5/-	27/6	+1/-	35	17½*	3	3	9	36/6	25/6
Watford	2/-	6/9		25	20*	5	18	6	10/9	6/6
Westinghouse	£1	23/6		11	11	9	3	6	45/-	23/6
West, Allen	5/-	10/-		12½	13½	6	15	0	14/6	10/-
Wilkins & Mitchell	5/-	8/3		21	12	7	5	6	15/3	8/3
Wolf Electric	5/-	12/9		12½	13¾	5	7	9	17/6	12/6

Louis Newmark

Dealings began last week in the 5s ordinary shares of Louis Newmark at prices around 9s 6d. Particulars published in connection with their introduction to the market showed that the earlier business of watch making had been discontinued so as to leave more room for the growth of the newer interests in electronic and electromechanical instruments. These, in conjunction with aviation control gear, are expected to account for about half future profits. Earnings of not less than £150,000 are forecast for the twelve months ending next March. At this rate there would be more than threefold cover for the forecast dividend of 8 per cent, on which basis the shares offer a yield of 4¼ per cent.

F. H. Wheeler Issue

Other recent newcomers to the market were the 1s shares of F. H. Wheeler & Co., the electrical engineers and contractors, some of whose largest current contracts are for Richard Thomas and Baldwins, Ford Motor and the new Shell headquarters. They come to the market by way of an offer of a million shares at 2s each to shareholders and certain employees of K.G. (Holdings), who retain a controlling interest through holding the deferred capital. For 1961–2 the directors envisage profits at least equal to last year's of £165,000, and dividends of 25 per cent on the ordinary and 5 per cent on the deferred shares. Quoted in initial dealings at an all-in price of about 3s 6d, the former offer a prospective yield of over 7 per cent.

Strand Electric

With an already notable record of progress behind them, Strand Electric reported a further advance of more than 50 per cent in the earnings of 1960–61, and although a much heavier tax provision reduced the improvement in the net surplus to 18 per cent this still provided a very comfortable margin for the increase in the dividend from the equivalent of 14⅔ to 20 per cent. At the annual meeting the chairman described prospects as bright: he saw no reason why this year's figures should not be at least as good as those just reported. There has been a good demand for the 5s shares up to 18s 3d since the publication of the results, and the yield is now 5½ per cent.

REPORTS and DIVIDENDS

E.M.I. Preference Reorganisation.—Sir Joseph Lockwood, chairman, said at last week's meeting that it is proposed to give the present two preference classes equal rank and to remove the prohibition against the issue of further preference capital. There is no present intention, he said, to make a preference issue but it would be advantageous to be able to do so. He added that the proposals would include provision for the payment of an additional $\frac{1}{2}$ per cent per annum to the first preference holders and an additional $\frac{1}{4}$ per cent per annum to the second preference holders as compensation for altering their rights.

Radio & Allied Holdings, Ltd.—Profits fell from £655,107 for the year to 30th April, 1960, to £350,627 for the 11 months to 31st March last, after depreciation of £63,731 (£56,048) and tax £384,000 (£642,353). There remains to be added a tax credit of £410,000, as a result of the accounting date change.

Last January, prior to the offer by G.E.C. for the capital, it was stated that the directors anticipated a reasonable, although appreciably lower, profit for 1960-61. The total dividend, as already announced, is maintained at 30 per cent.

Waite & Son, Ltd.—Profits for 1960 totalled £70,926, before tax of £27,500, following the loss last year of £13,777. After a lapse of eight years the company announces a dividend of 20 per cent on the 2s shares. The directors estimate that profits for 1961 should be not less than £90,000, before tax.

The company proposes to acquire the issued capitals of the Apex Manufacturing Co., the Auro Lampshade Co. and Adalight, and also certain assets of the lampshade business of E. & R. Jarvis for £135,000, to be satisfied by the issue of 300,000 ordinary 2s shares. The new shares will not rank for any dividend to be declared in respect of the year ending 31st December, 1961.

Rolls Razor, Ltd.—A trading loss of £232,161 after interest, etc., was incurred in 1960, against a deficit of £35,306 the previous year. The loss is after provision for depreciation and after providing £25,000 for servicing washing machines sold under guarantee. Mr. R. Reader Harris, chairman, says that the company is taking additional premises with the idea of increasing production of washing machines.

The company proposes to exercise its option to acquire all the capital of the Electromatic Washing Machine Co. as from 1st January last.

Interim consolidated accounts of Rolls Razor and Electromatic for the nine months to 30th September, 1961, show a profit, after all charges except tax, of approximately £280,000. This has been achieved on sales of washing machines of 1,100 per week during the first quarter, 1,300 in the second quarter and 1,400 in the third quarter. Sales are now running at approximately 1,700 machines weekly.

An extraordinary meeting is to be held at Cricklewood Broadway, N.W., on 29th December, following the annual meeting at 10.30 a.m., to consider the proposed acquisition and an increase in the capital to £400,000 by the creation of an additional 2,000,000 deferred 1s shares.

The directors hope to make application for the restoration of the London Stock Exchange quotation for all the issued capital after the 1961 accounts have been approved.

Brook Motors, Ltd., has declared a final dividend of 20 per cent, making 25 per cent for the year to 30th September. Group profits increased from £681,917, to £983,609, reducing to £545,780 (£325,433) after tax. A one-for-ten scrip issue is proposed for holders as at 5th January from the capitalisation of £100,896 of reserves.

Strand Electric Holdings, Ltd.—Mr. J. D. H. Sheridan, chairman, said at the annual meeting in London last week that the U.K.'s entry into the Common Market should help the company. But if it meant that the company's Commonwealth interests would be damaged, then, he said, the board would prefer the U.K. not to join.

Courtney Pope Holdings, Ltd., is raising its final dividend by $2\frac{1}{2}$ per cent to 20 per cent, making 25 per cent for the year ended 31st May. Group profits increased from £84,022 to £88,070, after tax of £96,834 (£81,318).

Telephone Rentals, Ltd., is raising its interim dividend from the equivalent of $4\frac{1}{6}$ per cent to 5 per cent on capital increased by a one-for-five scrip issue. Maintenance of the actual 15 per cent rate paid for 1960—equivalent to $12\frac{1}{2}$ per cent—has been foreshadowed.

W. H. Smith & Co. (Electrical Engineers), Ltd.—Mr. John P. Hunt, chairman of Staveley Industries, Ltd., the parent company, reports increased turnover and profits for the year ended 30th June last. Order books for both the contracting and manufacturing departments are satisfactory with contracts completed or in hand covering a wide field of industrial requirements, including two nuclear power stations.

Tube Investments, Ltd.—Members were told by Sir Ivan Stedeford at Monday's meeting that unless there was a marked improvement in trade very soon, the company was unlikely to make a complete recovery this year from the reversals which had already been caused by the Government's financial policy. "I have no doubt," he said, "that given a reasonable chance, the Government's measures to strengthen the economy will achieve their purpose. From the company's point of view, however, with the financial year ending on 31st July next, unless there is a marked improvement in trade before long it is unlikely to be in time to make nearly good the reverse already suffered."

He said that in the latter event it was unlikely that the group results would be significantly different from those of 1959-60.

Senior Economisers, Ltd., announce that £525,000 of new money is being raised by a rights issue, although to some extent the expansion plan can be met from the company's own resources. Ordinary shareholders of 15th December have the right to 4·2 million 1s shares at 2s 6d each on a one-for-two basis. Profits before tax for 1961 are expected to be in the region of £400,000, compared with £313,663 in 1960.

New Companies

Osram (Great Britain), Ltd.—Registered 29th November. Capital £100. Illuminating engineers, etc. Subscribers: S. H. Mayo and D. M. Vickers, Magnet House, Kingsway, W.C.2. Solicitors: Herbert Smith & Co., 62, London Wall, E.C.2.

Ladd, Son & Co., Ltd.—Registered 29th November. Capital £100. General merchants and retailers of electric motors and electrical equipment, etc. Directors: D. E. Ladd (secretary) and Mrs. Margaret M. Ladd. Regd. office: Bank House, Narberth, Pembs.

W. T. Reeves, Ltd.—Registered 29th November. Capital £100. Manufacturers of and dealers in radio, electrical and mechanical apparatus, etc. Directors: W. T. Reeves and Edna M. Reeves (secretary). Regd. office: 188, High Street, Rickmansworth.

Liquidations

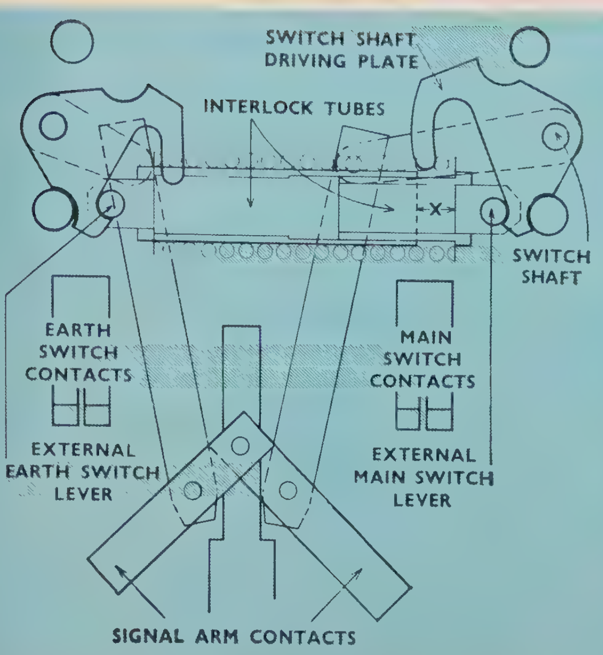
Winding-up proceedings or liquidations are often undertaken for the purpose of reconstruction, the transfer of a business, or other reasons. The appearance of a company's name under this heading therefore does not necessarily indicate insolvency.

J. O. Archer, Ltd., television, radio and electrical goods dealers, 67, Newhall Street, Birmingham, 3.—Liquidator, Mr. W. L. Hand, Colmore House, 21, Waterloo Street, Birmingham, 2, appointed 23rd November.

Holland Domestic Supplies, Ltd., 3, King's Avenue, Holland-on-Sea, Essex, retailers of

(*Continued on page* 981)

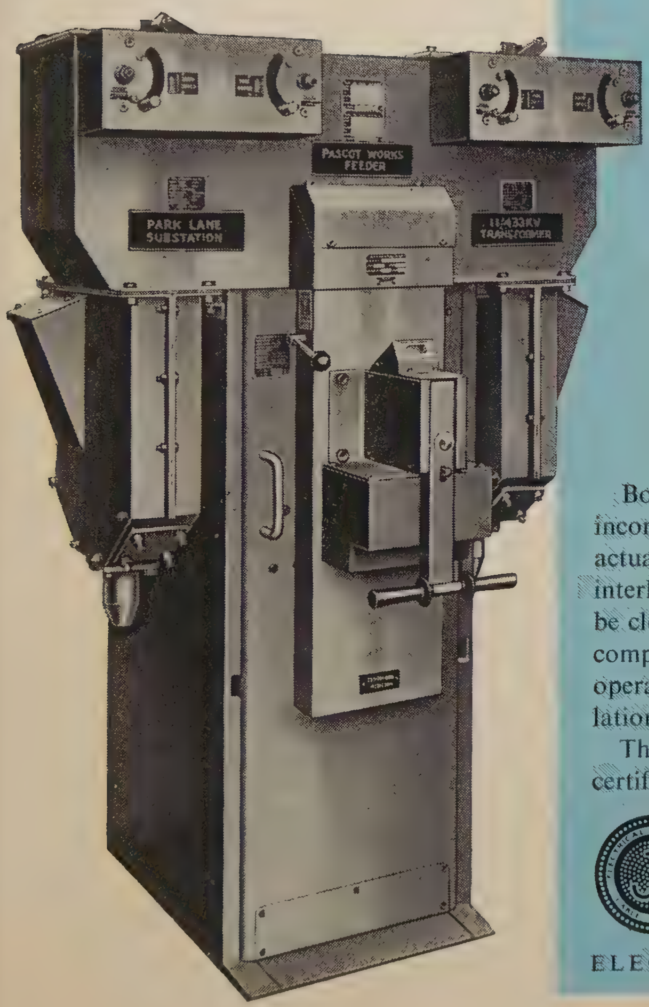
J. & P. *lead the field*



OVER 600 UNITS WITH MANUAL SPRING-OPERATED MECHANISMS

have been supplied or ordered

J. & P.



TYPE NX

RING MAIN UNITS

AND TYPE SX

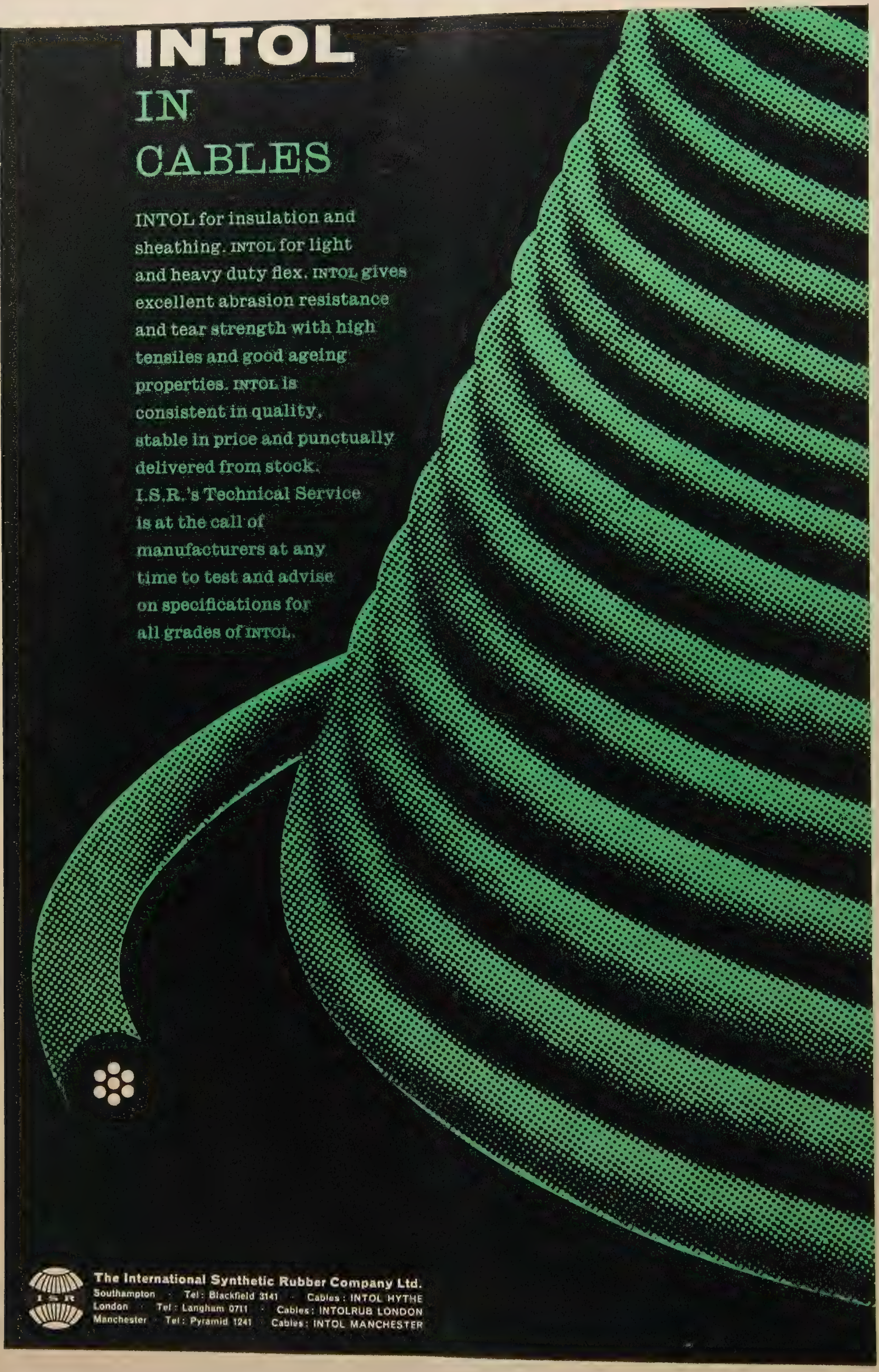
OIL SWITCHES

for 6.6 kV systems up to 250 MVA
and 11 kV systems up to 350 MVA

Both the Type NX ring main unit and the Type SX oil switch incorporate mechanisms with separate main and earth switches actuated by a common spring arranged to provide an integral interlock. This ensures that the main and earth switches cannot be closed at the same time. Operation of the switch, after initial compression of the spring, is entirely independent of the operator's speed and the hazards arising from hesitant manipulation are completely eliminated.

These mechanisms were incorporated in units, tested and certified to B.S.2631: 1955 at K.E.M.A. as far back as 1958.

JOHNSON & PHILLIPS LTD.
CHARLTON · LONDON · S.E.7.
Overseas Factories in Australia, South Africa, Pakistan and India
ELECTRICAL ENGINEERS AND CABLE MAKERS



INTOL IN CABLES

INTOL for insulation and sheathing. INTOL for light and heavy duty flex. INTOL gives excellent abrasion resistance and tear strength with high tensiles and good ageing properties. INTOL is consistent in quality, stable in price and punctually delivered from stock. I.S.R.'s Technical Service is at the call of manufacturers at any time to test and advise on specifications for all grades of INTOL.

The International Synthetic Rubber Company Ltd.

Southampton · Tel: Blackfield 3141 · Cables: INTOL HYTHE
London · Tel: Langham 0711 · Cables: INTOLRUB LONDON
Manchester · Tel: Pyramid 1241 · Cables: INTOL MANCHESTER

FINANCIAL SECTION (*continued*)

electrical goods and furniture.—Liquidator, Mr. R. A. Paterson, Archdeacons House, Northgate Street, Ipswich, appointed 9th November.

Durham Electrical (Wholesalers), Ltd., radio and electrical wholesalers, Kings Works, Langley Park, Co. Durham.—Winding up voluntarily. Liquidator, Mr. R. A. Hawken, Bank Chambers, 1, John Street, Bedford Row, London, W.C.1, appointed 29th November.

Southern Electrical Suppliers, Ltd., electrical suppliers, 35, St. Johns Road, Isleworth, Middlesex.—Liquidator, Mr. H. C. Hedges, 4, Charterhouse Square, London, E.C.1, appointed 29th November.

Central Refrigeration & Heating Engineers, Ltd., 68a, Sycamore Road, Handsworth, Birmingham, 21.—Liquidator, Mr. G. H. Norris, 32, High Street, Erdington, Birmingham, 23, appointed by company on 2nd December.

Bankruptcies

P. K. W. Toon, residing and carrying on business at 47, Hawfield Lane, Winshill, Burton-upon-Trent, Staffs., electrical contractor.—Receiving order made 20th November on debtor's petition. Public examination 16th January at County Court House, 165, Station Street, Burton-on-Trent.

A. McGuirk, formerly carrying on business in partnership with another and lately on his own account at 12, South Street, Harborne, Birmingham, 17, under the style of Victor Sound and Vision Services, as an electrical, radio and television dealer.—First meeting 20th December at the Official Receiver's Office, Somerset House, 37, Temple Street, Birmingham, 2. Public examination 31st January at the Court House, Corporation Street, Birmingham, 4.

Mitchell Electric Co., carrying on business at 88-90, Tennant Street, Birmingham, 15.—First meeting 21st December at the Official Receiver's Office, Somerset House, 37, Temple Street, Birmingham, 2. Public examination 31st January at the Court House, Birmingham, 4.

A. C. Hart, 256, High Street, Berkhamsted, Herts., radio and electrical engineer.—Trustee, Mr. R. A. Hawken, Bank Chambers, 1, John Street, London, W.C.1, appointed 4th December.

K. R. Cockerton, hardware and electrical dealer, carrying on business at 206, Herbert Avenue, Parkstone, Dorset, under the name of Bournemouth Domestic Appliance Services.—Last day for receiving proofs for dividend 22nd December. Trustee, Mr. M. J. Bright, 121, Commercial Road, Southampton, Hants.

W. Canning, trading as Cannings Electrical Co., at 47, Goldhawk Road, London, W.12, electrical contractors and retailers.—Application for discharge to be heard 11th January at Bankruptcy Buildings, Carey Street, London, W.C.2.

K. W. Roberts, formerly residing and carrying on business in partnership with another under the style of K. Roberts Electrical as dealers in electrical goods at 1-3, Oglander Road, London, S.E.15.—Last day for receiving proofs for dividend 20th December. Trustee, Mr. E. C. Sherwood, Bankruptcy Buildings, Carey Street, London, W.C.2.

G. B. Barnes, radio and electrical engineer, carrying on business at 23, Front Street, Brampton, Cumberland, as A.B.C. Electrical Co.—Third dividend of 2s 8d in the £ payable at the Official Receiver's Office, Lowther Street, Carlisle.

E. W. Gascoigne and **T. Nash,** lately carrying on business in partnership under the style of Regal Electrics at 53, High Street, Fareham, Hants., electrical appliance distributors.—Receiving order made 4th December on debtors' petition. First meeting today (Friday) at the Official Receiver's Office, 16, Westwood Road, Southampton. Public examination 5th February at the County Court, Sussex Street, Portsmouth.

Parliamentary Report

Railway Electrification Schemes

The British Transport Commission has authorised expenditure of £5,142,100 for works and plant for electrification between Cheadle Hulme and Kidsgrove Central stations and between Stoke-on-Trent and Colwich, Mr. Ernest Marples, the Minister of Transport, said in a written answer to Mr. Ellis Smith (Lab., Stoke-on-Trent, South). He said electrification of the North Staffordshire line would involve the provision of a main line by-pass for the Harecastle tunnels. It should be completed in 1966. The total cost was estimated at £8,200,000. He understood that the Commission had no plans for electrifying either the Crewe-Kidsgrove line or the North Staffordshire loop line.

Communications Satellites

Viscount Hailsham, the Minister for Science, replying to a debate in the House of Lords on space research, was guarded about the future of space communications satellites. Speaking after there had been considerable pressure from a number of peers that Britain should go ahead with plans for such satellites, the Minister said that it was hoped more would be learnt from a series of experimental tests which would take place next year in co-operation with the Americans. There was at the moment a wide difference of view about the commercial prospects of communications satellites.

He agreed that it was now established, in theory at least, that it would be possible to utilise satellites in place of cables and direct communications. Such satellites could, in theory, operate passively by reflecting signals from the ground, but they were more likely to be used semi-actively by boosting them, or actively by re-broadcasting them. Such a system would have many advantages, including an almost unlimited number of available channels. The cost would be high. The life of the satellite was uncertain; and whether, if it succeeded, the system would complement or replace the new and expensive cables which were now being laid, was not known.

Lord Hailsham said that in parallel with the studies made by the British Space Development Co., studies of a possible design had been made jointly by the Post Office and the Ministry of Aviation. It was, perhaps, natural that the Post Office should take a more cautious view than the company, and the assessment of some of the elements that entered into a commercial assessment of communications must be matters of opinion. There was no doubt that a wide difference existed. He understood that the company's estimates of the cost for establishing a system were less than half the estimates made by the Post Office, and the company assumed a much faster rate of growth. For these reasons the Post Office considered that they must look forward to a date considerably later than that estimated by the company as the date by which a satellite communication system could begin to pay.

Much would depend on the arrangements made with the Americans, who were bound, as he saw it, to be the first to have such a system in being. The British Space Development Co. had sent to the Postmaster General a copy of the report setting out their proposals. This report was being examined in detail, and he believed the Postmaster General would shortly be having a discussion with the company about it.

NEW ZEALAND SCHEME ABANDONED

Although an expenditure of about £3 million has been incurred on the civil work for the Maraetai No. 2 power station in the North Island, the New Zealand Government has decided that work on the station shall cease. The total cost was estimated at between £5 million and £6 million. It was stated in a report by the Power Planning Committee that Maraetai No. 2, as a peak-load station, would not add to the total output. Regard was also had to the Cook Strait cable, linking the North and South Islands, which is expected to be in commission by 1965. Generating plant already ordered for Maraetai will be diverted to other stations.

Higher Street Lighting Charges

The East Midlands Electricity Consultative Council at its meeting at Nottingham last week endorsed proposals by the Board for a revision of street lighting charges to take effect next April. Other tariffs were increased last April but street lighting charges have been unchanged since 1957-58. The Board does not propose to increase charges for street lamps which are lit all night and the revision of the charges for lamps which are lit for part of the night only will be limited to the increased cost of electricity supplied.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (4s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1956

34683. Associated Electrical Industries, Ltd.—Measurement of electrical resistance. 15th November, 1957. (882071.)

1957

5306. Plessey Co., Ltd.—Electrical control apparatus for controlling a machine tool or the like. 17th February, 1958. (881719.)

6576. Electric & Musical Industries, Ltd. —Colour television receivers. 20th February, 1958. (882014.)

7782. Associated Electrical Industries, Ltd.—Circuit arrangement for producing an output which is delayed with respect to its input. 7th March, 1958. (881651.)

9339. British Insulated Callender's Cables, Ltd.—Electric cable joints. 21st March, 1958. (881866.)

10016. Associated Electrical Industries, Ltd.—Magnetic cores and method of making same. 27th March, 1958. (881652.)

12696. English Electric Co., Ltd.—High-speed axial flow compressors. 11th April, 1958. (882015.)

17596. Associated Electrical Industries, Ltd.—Electrical remote control systems. 15th May, 1958. (881949.)

23708. Telegraph Condenser Co., Ltd., and Sporing, P. A.—Cylindrical electrical condensers. 9th April, 1958. (881950.)

26329. English Electric Co., Ltd., and Babcock & Wilcox, Ltd.—Nuclear reactors. 19th August, 1958. (881562.)

26620. Chadburns (Liverpool), Ltd.—Electric telegraph or remote control systems. 18th November, 1958. (881563.)

30433. General Electric Co., Ltd.—Ceramic dielectric materials. 3rd October, 1958. (881831.)

33728. Western Electric Co., Inc.—Bonding of metals to bodies comprising semiconductive or brittle materials. 29th October, 1957. (881832.)

35729. Radio Corporation of America.—Semiconductor devices. 15th November, 1957. (882076.)

36078. Columbia-Southern Chemical Corporation.—D.c. sources employing rectifying systems. 20th November, 1957. (881867.)

1958

6529. Western Electric Co., Inc.—Semiconductor devices and in methods of making such devices. 28th February, 1958. (881833.)

9420. Huet, A.—Nuclear reactors. 24th March, 1958. (881840.)

9518. Tarrago Sole, M., and Costa Vall-Verdu, J.—Electric lamps for motor vehicles. 25th March, 1958. (881954.)

9739. A.E.I.-John Thompson Nuclear Energy Co., Ltd.—Control rods for nuclear reactors. 10th April, 1959. (881853.)

10271. Hoover, Ltd.—Floor treating appliances. 31st March, 1958. (882020.)

10864. Soc. Générale de Constructions Electriques et Mécaniques Alsthom.—Electric insulator and method of making it. 3rd April, 1958. (881566.)

11131. United Kingdom Atomic Energy Authority.—Measuring apparatus. 24th March, 1959. (881620.)

15148. Crompton, A. J. L.—Drive mechanism for rotary contact electric make and break devices. 7th May, 1959. (881803.)

15663. C. A. Parsons & Co., Ltd.—Dynamo-electric machinery. 9th June, 1959. (881908.)

18020. Bush & Rank Cintel, Ltd.—Demountable electrical connections. 4th June, 1959. (881956.)

27883. International Computers & Tabulators, Ltd.—Electronic computing machines. 24th July, 1959. (881881.)

27884. International Computers & Tabulators, Ltd.—Electrical data storage devices. 24th July, 1959. (881909.)

30742. J. Stone & Co. (Deptford), Ltd. —Cooling of semiconductor devices. 25th August, 1959. (881571.)

31430. Power-Gas Corporation, Ltd.—Control systems for electric motors operating double skip hoists. 25th September, 1959. (881913.)

35540. General Electric Co., Ltd.—Glass-to-metal seals. 29th October, 1959. (881631.)

35828. General Electric Co., Ltd.—Snap-action devices. 4th November, 1959. (881632.)

35989. Langham Thompson, Ltd., J.—Manufacture of electrical components. 10th November, 1959. (881583.)

36319. O'Connor, D.—Conduits for electric leads and cables. 5th November, 1959. (881847.)

37962. McGraw-Edison Co.—Electrostatic filter. 25th November, 1958. (881633.)

39005. General Electric Co., Ltd.—Apparatus for the detection of cracks. 3rd December, 1959. (881765.)

1959

8915. Ega Electric, Ltd.—Trunk conduits. 13th June, 1960. (881995.)

12249. Associated Electrical Industries, Ltd.—Dynamic braking of induction motors. 6th April, 1960. (881983.)

13178. Mullard, Ltd.—Semiconductor devices. 17th April, 1959. (881572.)

15351. General Electric Co.—Turbine speed limiting arrangement. 5th May, 1959. (881850.)

15433. Associated Electrical Industries, Ltd.—Transistors. 22nd April, 1960. (881646.)

15670. Electrofilm, Inc.—Electrically heated surface coverings. 7th May, 1959. (881544.)

16266. Associated Electrical Industries, Ltd.—Electric oil circuit-breakers. 12th August, 1960. (881996.)

16747. Standard Telephones & Cables, Ltd.—Combining system for diversity communication systems. 15th May, 1959. (881548.)

18586. General Electric Co., Ltd.—Electric oscillation generators. 31st May, 1960. (881549.)

18999. Associated Electrical Industries, Ltd.—Mechanically flexible electrical coupling devices. 1st June, 1960. (881971.)

20427. A.E.I.-Hotpoint, Ltd.—Electric immersion heaters. 6th May, 1960. (882024.)

24187. Electric Auto-Lite Co.—Electrical system for igniting combustible mixtures. 14th July, 1959. (881885.)

26156. Electrolux, Ltd.—Vacuum cleaner having a filter. 30th July, 1959. (881975.)

26715. Commissariat à l'Energie Atomique. —Electrical connectors. 5th August, 1959. (881886.) 28489. Nuclear reactors. 20th August, 1959. (881790.)

29613. Electrolux, Ltd.—Vacuum cleaners. 31st August, 1959. (881594.)

30443. Fernseh G.m.b.H.—Arrangement for synchronising pulse generators. 7th September, 1959. (881793.)

31432. Hoover, Ltd.—Suction cleaners. 15th September, 1959. (881937.)

31449. A.E.I.-John Thompson Nuclear Energy Co., Ltd.—Radiation shielding for nuclear equipment. 31st August, 1960. (882031.)

32394. Philips Electrical Industries, Ltd. —Piezo-electric transducers. 23rd September, 1959. (881626.)

39687. Soc. Industrielle de Liaisons Electriques.—Electrical couplings. 23rd November, 1959. (881914.)

39916/7. Allis-Chalmers Manufacturing Co.—Enclosed electrical switchboard structure and shutter mechanism therefor. 24th November, 1959. (881704/5.)

42093. United-Carr Fastener Corporation.—Electrical assemblies. 10th December, 1959. (881670.)

44090. General Electric Co.—Nozzle assembly for electric arc spray apparatus. 29th December, 1959. (881672.)

1960

496. Prvni Brnenska Strojirna, Zavody Klementa Gottwalda Narodni Podnik.—Electric circuit for the automatic reversal of the electric drive of a steam boiler blower. 6th January, 1960. (881800.)

14942. Philips Electrical Industries, Ltd. —Colour television receivers. 28th April, 1960. (881608.)

17364. Telefunken G.m.b.H.—Electromagnetic wave transmission arrangements. 17th May, 1960. (881824.)

20113. Siegler Corporation.—Static excitation system for an alternator. 8th June, 1960. (881922.)

22211. Tesla, Narodni Podnik.—Code translators for automatic telephone systems. 24th June, 1960. (881618.)

26640. Zavody V. I. Lenina Plzen, Narodni Podnik.—Interconnection and conductor bars of dynamo-electric machines. 2nd August, 1960. (881826.)

29253. Philips Electrical Industries, Ltd. —Semiconductor devices. 24th August, 1960. (881579.)

29541. Mefina S.A.—Process for washing dishes and a washing machine for carrying out said process. 26th August, 1960. (882011.)

1961

14256. Western Electric Co., Inc.—Bonding of metallic leads to semiconductor elements. 29th October, 1957. (881834.)

22745/7. Columbia-Southern Chemical Corporation.—D.c. power sources employing rectifying systems. 20th November, 1957. (881868/70.)

Trade Mark Applications

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to the dates stated:—

22nd December

B.M.C. (design on rosette). No. B777,843. Class 11. Electric lamp bulbs for motor vehicles.—British Motor Corporation, Ltd., Longbridge Works, Longbridge, Birmingham.

Lamp-Master (design). No. 818,575. Class 11. Miners' lamps for attachment to headgear.—John T. Moss, Ltd., Church Street, Holloway, Matlock.

Philips. No. 819,684. Class 11. Heating apparatus.—Philips Electrical, Ltd., Century House, Shaftesbury Avenue, London, W.C.2.

Unicon. No. 802,493. Class 11. Economisers.—E. Green & Son, Ltd., Economiser Works, Calder Vale Road, Wakefield, Yorks.

29th December

Sciaky. No. B805,736. Class 7. Electric welding machines.—Sciaky Electric Welding Machines, Ltd., Falmouth Road, Trading Estate, Slough, Bucks.

Pye. No. 821,853. Class 9. Electrodynamic vibrators for testing; power amplifiers; electric power supply units; and electronic measuring and controlling apparatus. Nos. B823,468 and B823,469. Classes 9 and 11. Domestic electrical appliances.—Pye, Ltd., Radio Works, St. Andrews Road, Cambridge.

PRODUCTION PROBLEMS?

THE ANSWER COULD BE IN VOLTAGE REGULATION

BRENTFORD

Brentford Transformers Limited, Manor Royal, Crawley, Sussex. Tel: Crawley 27755. *A member of the GHP Group*

FOR SILICON
POWER RECTIFIER
EQUIPMENTS
STANDARD
OR SPECIAL . . .

Besides special designs for
particular applications,
G.E.C. produces a standard
range for many industries

rely on the
experience of

G.E.C.

G.E.C. (ENGINEERING) LIMITED · RECTIFIER AND ELECTRONICS DIVISION · BIRMINGHAM 6

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Abergele.—U.D.C. 19th December. Sodium lighting in several roads, forming part of the A.548. Engineer and surveyor, Town Hall, Pentre Mawr, Abergele.

Australia.—Controller, Stores and Contracts, P.M.G.'s Department, Melbourne. Electrical equipment. (E.S.B. 37206/61.)*

State Electricity Commission of Victoria. 8th January. 6·6/11 kV switchgear. (E.S.B. 37563/61.)*

Cairns Regional Electricity Board, North Queensland. 9th January. Insulators. (E.S.B. 37505/61.)*

Blackpool.—Corporation. 8th January. Electric lamps. (See Classified Advertisement Section.)

Burma. — Director General, Union of Burma Purchase Board, Rangoon. 27th December. Generating plant. (E.S.B. 37550/61.)*

Canada.—Manitoba Hydro. 13th February. Waterwheel turbine and generator. (E.S.B. 37221/61.)*

Colombia.—Instituto Nacional de Fomento Municipal, Departamento Commercial, Bogota. 8th January. Hydro-electric equipment. (E.S.B. 37222/61.)* Diesel-electric plants. (E.S.B. 37224/61.)*

Cumberland.—Health Committee. 29th December. Radio-communication equipment. (See Classified Advertisement Section.)

Dorset.—County Council. 15th January. Electric lamps. (See Classified Advertisement Section.)

Ethiopia.—Imperial Board of Telecommunications, Addis Ababa. 30th December. Cable. (E.S.B. 37522/61.)*

Huntingdonshire.—County Council. 17th January. Lighting installation at roundabout on Buckden By-pass (A.1). (See Classified Advertisement Section.)

Ilford.—Borough Council. 1st January. Electric cable and g.l.s. electric lamps. Borough engineer and surveyor.

India.—Supply Mission, Washington, D.C. 4th January. Electrical equipment. (E.S.B. 37912/61.)*

Iraq.—Purchase and Tender Office, Iraqi Ports Administration, Basrah. 31st December. Eighteen electric hot air hand dryers. (E.S.B. 37600/61.)*

Directorate of Contracts and Purchases, Ministry of Defence, Baghdad. 17th January. Electronic valves. (E.S.B. 36676/61.)*

Irish Republic.—Department of Posts and Telegraphs. 1st February. Telephone equipment. (E.S.B. 37595/61.)*

Manchester.—City Council. 20th December. Electrical installation at Miles Platting Secondary School. City architect, P.O. Box 488, Town Hall.

Morocco.—Ministry of Public Works. 1st March. Turbo-alternators. (E.S.B. 37521/61.)*

New Zealand.—Director General (Stores Division), G.P.O., Wellington. 26th January. Toggle switches. (E.S.B. 37580/61.)* Terminals. (E.S.B. 37581/61.)*

Northern Ireland.—1st January. Electrical installation in new school at Lurganville, Co. Down. Houston & Beaumont, 9, Market Street, Lurgan, Co. Armagh.

Nottingham.—City Council. 8th January. Two centrifugal pumps and electric motors, switchgear, etc., at Newstead booster station. B. W. Davies, engineer and general manager, Water Department, Castle Boulevard, Nottingham.

Pakistan.—Chief Controller of Stores, P.E. Railway, Pahartali, Chittagong. 4th and 8th January. Generating sets. (E.S.B. 37247/61 and 37249/61.)* 6th January. Refrigeration equipment. (E.S.B. 37248/61.)*

Director (Stores), Electricity, Water and Power Development Authority, Lahore. 29th December. Cables. (E.S.B. 37599/61.)*

Reigate.—Borough Council. 29th December. Electrical fittings. Borough engineer, Town Hall.

Rhodesia and Nyasaland.—Bulawayo Electricity Department. 24th January. Switchgear, battery and chargers. (E.S.B. 37511/61.)*

South Africa.—Stores Department, South African Railways. 2nd March. Electrical substation equipment. (E.S.B. 36928/61.)*

South Derbyshire.—Water Board. 8th January. Two submersible pumping units; three horizontal centrifugal pump sets; and three horizontal centrifugal pump sets. Engineer and general manager, 1, Tenant Street, Derby.

Thailand.—State Highways Department (Phya Thai). 26th December. Generator. (E.S.B. 37255/61.)*

United States.—Bonneville Power Administration. Transformers. Closing date for tenders extended to 16th January. (E.S.B. 27062/61.)*

Uruguay.—Administracion General de las Usinas Electricas y los Teléfonos del Estado, Montevideo. 28th December. Insulating materials. (E.S.B. 36985/61.)* 29th December. Cables. (E.S.B. 36984/61.)* 3rd January. Condenser tubes. (E.S.B. 36983/61.)*

Wanstead and Woodford. — Borough Council. 5th January. Electric lamps. Borough engineer, Municipal Offices, Woodford, E.18.

West Lancashire.—R.D.C. 8th January. Sodium lighting installation. (See Classified Advertisement Section.)

West Lothian.—County Council. 30th December. Sodium lanterns. (See Classified Advertisement Section.)

ORDERS PLACED

Glasgow.—Housing Committee. Provision of eight electric passenger lifts at Pollokshaws (£43,666).—Glasgow Engineers.

Education Committee. Electrical installation work at the Damshot Road Secondary School (£33,648).—James Kilpatrick & Son. Electrical installation in Anniesland College of Further Education (£30,640).—B. French.

London.—London County Council. Provision of electric water heaters in 405 dwellings, Becontree estate (£22,090).—F. J. Baynes & Co. Electric water heaters in 273 dwellings, St. Helier estate (£16,194).—Ellis (Kensington). Electrical installations in Wellesley Buildings, Churchway estate, St. Pancras (£2,621).—Renouf & Calvert.

Woolwich Borough Council. Supply and erection of 81 concrete street lighting columns (£3,249).—Erecon.

Sheffield.—Education Committee. Electrical installation for Stage II of Lyers Grove School (£21,133).—T. W. Sampson & Co.

Markets Committee. Refrigeration equipment for public abattoir.—Bradley & Lomas (Refrigeration) (£9,230) and L. Sterne & Co. (£13,126).

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Basingstoke.—Houses (54), Cavalier Road, Old Basing; R.D.C. surveyor, Eastlands, London Road.

Berwick.—Shops and offices at Marygate for Montagu Burton, Ltd., tailors, Hudson Road Mills, Leeds.

Biggleswade.—Factory, Astwick Road, Stotfold; Foster Instrument Co., Ltd., Letchworth.

Billingham-on-Tees. — Second shopping block (£125,000); Elder & Lester, architects, Midland Bank Chambers, Town Square.

Birchington.—Flats (50), Spencer Road; Gotch & Partners, architects, 26, Regency Square, Brighton.

Blackpool. — Showrooms and offices; Mercury Garages, Ltd., Maitland Avenue.

Bournemouth.—Two courtrooms and restaurant as extensions to Law courts (£184,000); borough engineer, Town Hall.

Burnley.—Dance hall, Yorkshire Street; Mecca, Ltd., 76, Southwark Street, S.E.1.

Cambridge.—New headquarters for the East Anglian Regional Hospital Board; Johns, Slater and Haward, architects, 32, Foundation Street, Ipswich.

Carlisle.—New premises for Littlewood Stores, Ltd., Liverpool.

Castle Ward.—Premises on the Ponteland site for Alderson & Co., Sunderland; Matkin & Hawkins, architects, Barclays Bank Chambers, Fawcett Street, Sunderland.

Cheltenham.—Petrol and service station, Gloucester Road; Petrofina, Ltd., Petrofina House, York Road, S.E.1.

Chester-le-Street.—Shops and store, Front Street, for J. & G. Archibald, Ltd.; Cordingley & McIntyre, architects, Owengate, Durham City.

Clay Cross.—Factory for John Smedley, Ltd., hosiery mfrs.; J. W. Wildgoose & Sons, Ltd., Industrial Works, Matlock.

Croydon.—Offices, workshops and laboratory; E. Holbrooke & Son (Croydon), Ltd., 72, Lower Addiscombe Road.

Factory, 97-99, Gloucester Road; John Norman, Ltd., 97, St. John's Hill, London, S.W.11.

Dundee.—Two 15-storey blocks of flats, Harefield Road; Scottish Special Housing Association, Ltd., 15, Palmerston Place, Edinburgh.

East Barnet.—Instalment of replacement school for John Hampden S.M. School (£233,315); county architect, County Hall, Hertford.

Eastbourne.—Flats (24), Bourne Street; borough engineer.

Edinburgh.—Works extension (£50,000); T. & H. Smith, Ltd., Blandfield Chemical Works, Wheatfield Road.

Large housing scheme, Kirkgate Development, Leith; A. Steele, city architect, City Chambers, High Street.

Farnborough.—Warehouse and offices, Hawley Lane; Fine Fare, Ltd., 2, Mundells, Welwyn Garden City.

Gateshead.—Children's unit at Sheriff Hill Hospital; Fennell & Baddiley, architects, Bridge End Chambers, Chester-le-Street.

Grimsby.—Hostel for Missions to Seamen, Immingham Dock (£30,000); J. F. Pye, architect.

[*Continued on next page*

*** This information is extracted from the Board of Trade *Export Service Bulletin*. Inquiries should be addressed to the Board of Trade, Export Services Branch, Lacon House, Theobald's Road, London, W.C.2 (Telephone: Chancery 4411, Ext. 738), quoting the reference given.**

WORK IN PROSPECT (*continued*)

Guisborough. — Primary school; Tom Mellor, architect, Market Hall, Lytham St. Annes.

Harlow.—Comprehensive training centre for mentally handicapped persons, Tendring Road; county architect, County Hall, Chelmsford, Essex.

Hemel Hempstead.—Senior training centre, St. Albans Road (£41,180); county architect, County Hall, Hertford.

Horbury.—Office block; Richard Sutcliffe, Ltd., Benton Hill Works.

Houghton-le-Spring.—Houses on 35 acres of land at Sunniside; U.D.C. surveyor.

Huddersfield.—County secondary school and civic youth centre, Almondbury; planning officer, High Street Buildings.

Jarrow.—Seven- or eight-storey office block; Arndale Property Trust, Ltd., Bradford.

Longbenton.—R.C. church; D. Brown, architect, 10, Lambton Road, Jesmond, Newcastle-on-Tyne.

London.—Dwellings (244), Wrotham Road, Camden Town; J. M. Austin-Smith & Partners, architects, 29, Sackville Street, W.1.

Rebuilding Colfe's Grammar School, Horn Park Lane, Lee; Louis de Soissons & Partners, architects, 3, Park Square Mews, N.W.1.

Shops and flats, High Street, Wimbledon; D. A. Degerdon & Partners, surveyors, 12, Goodwins Court, W.C.2.

Factory, Club Row, Bethnal Green; E. M. Hyams & Co., Ltd., 246, Goswell Road, E.C.1.

Manchester.—Shackliffe Green Secondary School, Moston; city architect, P.O. Box 488, Town Hall.

Middlesbrough.—Housing estate (432 houses and 152 flats) near Ormesby Road; J. A. Kenyon, borough engineer.

Moreton-in-the-Marsh.—Old people's flats (40); Pyle & Saint, consulting architects, 3, Roseville, Oxford Street, Moreton-in-the-Marsh.

Newcastle-on-Tyne.—Houses (700) and two schools at Kenton; E. Lyons, architect, Mill House, Bridge Road, Hampton Court, Surrey.

Additions to Kenton Secondary School; Spence & Price, architects, 26, St. Mary's Place, Newcastle.

Norwich.—Five-storey office block, 102-106, Prince of Wales Road; Eagle Star Insurance Co., Ltd., 1, Threadneedle Street, London, E.C.2.

Oundle.—Dwellings (20) for U.D.C.; surveyor, Oundle, Northants.

Peterborough.—Five three-storey blocks with flats and maisonnettes, Paston Ridings; city engineer.

Six-storey block of shops and offices, Corn Exchange site; Norwich Union Insurance Societies, Surrey Street, Norwich.

Peterlee.—Shopping and office block, Town Centre, for Development Corporation; W. H. Williamson & Partners, architects, 7, St. Mary's Place, Newcastle-upon-Tyne.

Ramsey (Hunts.).—Houses (46), Station Road, and houses (18), School Lane; Pick, Everard, Keay & Gimson, architects to U.D.C., 6, Millstone Lane, Leicester.

Reading.—Alfred Sutton Secondary Girls' School (£230,000); borough architect, Town Hall.

Maternity unit, Peppard Road, Caversham; Charles Smith & Son, architects, 164, Friar Street.

Romford.—Factory, Harold Hill; Sleepy Valley (Bedding), Ltd., 1a, Weymouth Terrace, E.2.

Roxburghshire.—Erection of new county offices (£250,000); county clerk, County Offices, Newtown St. Boswells.

St. Neots. — Works extensions; R.F. Development Co., Ltd., Priory Lane.

Second phase of Sandfields and Abrahams housing scheme; U.D.C. surveyor, St. Neots, Hunts.

Salford.—Flats (120), New Church site, Bury New Road, and alterations and extensions to Seedley County Primary School, Liverpool Street; city engineer, Town Hall, 3.

South Kesteven.—Dwellings (32); R.D.C. surveyor, North Street, Bourne, Lincs.

Stanley (Co. Durham).—Houses (84) at Lintz for U.D.C.; Thomas Armstrong, Ltd., contractors, 16, Robson Street, Newcastle-on-Tyne.

Stockton-on-Tees.—Branch library at Green Lane (£12,000); T. C. Hartley, borough architect, 28, The Square, Stockton.

Stoke Newington.—Public laundry and maisonnettes on site of old Town Hall, Milton Grove; Hurst, Pierce & Malcolm, consultants, Artillery House, Artillery Row, London, S.W.1.

Sunderland.—Proposed bowling centre at Dykelands Road for Canadian firm (£200,000); Munce & Kennedy, architects, 34, Seymour Street, London, W.1.

Whitley Bay.—Shops, flats and maisonnettes at Seaton Sluice; Waring & Netts, architects, 2, Lansdowne Terrace East, Gosforth.

Widnes. — Maisonnettes (140), Ditton estate; borough architect.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 243a, Dorset House, Stamford Street, London, S.E.1, to ascertain that the proposed dates for their functions do not clash with others already arranged, but, in some cases, not yet announced

MONDAY, 18th DECEMBER

Brigg.—Angel Hotel, 7 p.m. I.E.E. North Lincolnshire District. Discussion on "Apprentice Training," to be opened by A. L. P. Carter, F. C. Jones and N. L. Evans.

Bristol.—Grand Hotel, 8 p.m. A.S.E.E. Bristol and West of England Branch. "Fire Alarms," by D. E. Williams.

Liverpool.—Royal Institution, 6.30 p.m. I.E.E. Mersey and North Wales Centre. "Education of an Electrical Engineer," by Prof. M R. Gavin; and "The Place of Formal Study in the Post-Graduate Training of an Electrical Engineer," by N. N. Hancock and P. L. Taylor.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Electronics and Communications Section. "Large Microwave Steerable Aerials for Communication with Artificial Earth Satellites and Space Probes," by F. J. D. Taylor.

Newcastle-upon-Tyne.—Rutherford College of Technology, Northumberland Road, 6.15 p.m. I.E.E. North Eastern Measurement and Electronics Group. "Heaviside—His Life and Work," by Prof. R. L. Russell.

TUESDAY, 19th DECEMBER

Glasgow.—Scottish Building Centre, 425, Sauchiehall Street, 7 p.m. Institution of Heating and Ventilating Engineers, Scottish Branch. "Vibration Isolation," by E. H. Sims.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurement and Control Section. "The Use of Controllable Semiconductor Rectifiers in Machine Control," by K. G. King.

Great George Street, Westminster, S.W.1, 5.30 p.m. Institution of Civil Engineers. "The Hirfanli Hydro-Electric Scheme," by G. B. Finch and N. K. Webb.

WEDNESDAY, 20th DECEMBER

Bristol.—School of Management Studies, Unity Street, 6 p.m. British Institution of Radio Engineers, South Western Section. Annual general meeting, followed by "Transistors in Transmitters and Communications Receivers."

Glasgow.—Institute of Engineers and Shipbuilders in Scotland, 39, Elmbank Crescent, 7 p.m. Institute of Welding, West of Scotland Branch. "Welding of Pipe Installations for Power Stations," by J. Hammill.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Electronics and Communications Section. "Satellite Instrumentation," by Dr. R. L. F. Boyd.

School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1, 6 p.m. British Institution of Radio Engineers, Technical Committee. Technical films.

1, Birdcage Walk, Westminster, S.W.1. Institution of Mechanical Engineers, Internal Combustion Engines Group. Discussion on "Effect of Ambient Conditions on the Performance of Turbo-Charged Diesel Engines."

THURSDAY, 21st DECEMBER

Blackburn.—Castle Hotel, 7.30 p.m. Institution of Plant Engineers, Blackburn Branch. "The Merits of Various Heat Generation and Distribution Systems," by R. A. Wiggans.

Croydon. — Greyhound Hotel, 8 p.m. A.S.E.E. South London Branch. "Manufacture of Foodstuffs," by R. B. O. Harwood.

Grangemouth.—Leapark Hotel, Bo'ness Road, 7 p.m. Society of Instrument Technology, Grangemouth Section. "Instrumentation of Space Vehicles," by Dr. A. E. Roy.

Street Lighting Notes

Edinburgh Corporation Works Committee estimates that it will spend £125,000 during the coming financial year on the conversion of street lighting from gas to electricity, and about £12,500 on improved tenement lighting. The conversion of street lighting in the city should be completed within the next three years.

Nuneaton Corporation is recommended to seek sanction to borrow £3,400 for sodium street lighting in Whittleford Road and at Bucks Hill.

Stockton-on-Tees Town Council has received sanction to borrow £25,459 for improved street lighting.

Taunton Corporation is recommended to improve the street lighting in the town centre and in six other streets at a cost of £10,500.

Wells City Council has approved a scheme for new street lighting in the city estimated to cost £18,355.

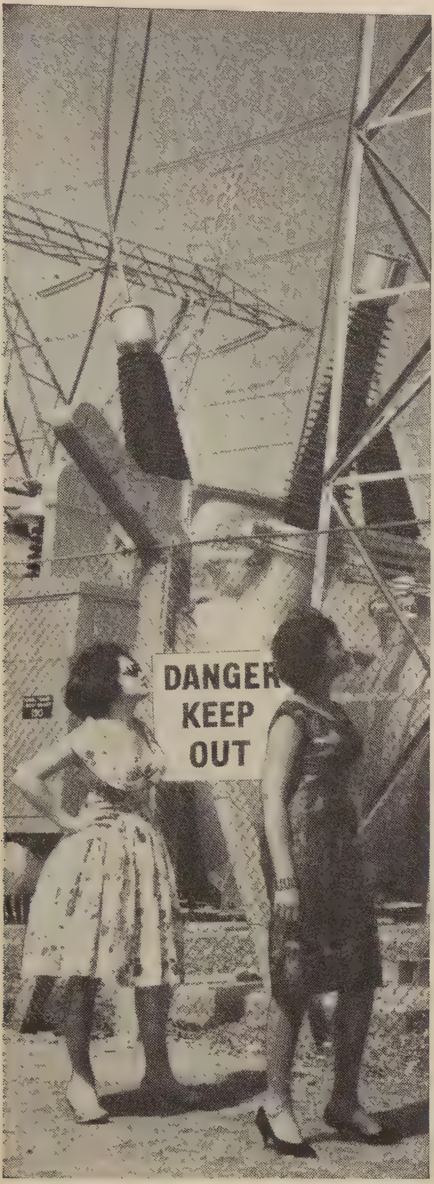
West Lancashire R.D.C. has approved a scheme for the lighting of trunk road A.565 through Water Lane and Gravel Lane, Banks, at an estimated cost of £4,062.

Woolwich Council is recommended to approve a scheme, estimated to cost £10,800, for Group "A" street lighting in Nightingale Place, Plumstead Common Road and The Slade.

St. Marylebone Borough Council is recommended to make application for sanction to borrow a further £41,000 for the main road lighting replacement scheme, and £60,000 for side street lighting.

Stage IV of **Ilford** Borough Council's scheme for improved lighting of classified and district roads is estimated to cost £82,300.

A £12,000 contract for lighting a 5½ mile stretch of the main Cardiff to Newport road has been completed by the A.E.I. Lamp & Lighting Co., Ltd., for **Magor and St. Mellons** R.D.C. "Mazda" 200 W sodium linear lamps are used and the illumination level is 10,000 lumens per 100ft linear. The "Amberline" lanterns with bracket outreaches varying between 6ft and 9ft are mounted on 35ft Stewarts & Lloyds steel columns spaced at intervals of up to 170ft along the 40ft four-lane road.



MAIN CONTRACTORS: A.E.I. Ltd.
CONSULTING ENGINEERS: Merz & McLellan

insulating

KARIBA'S

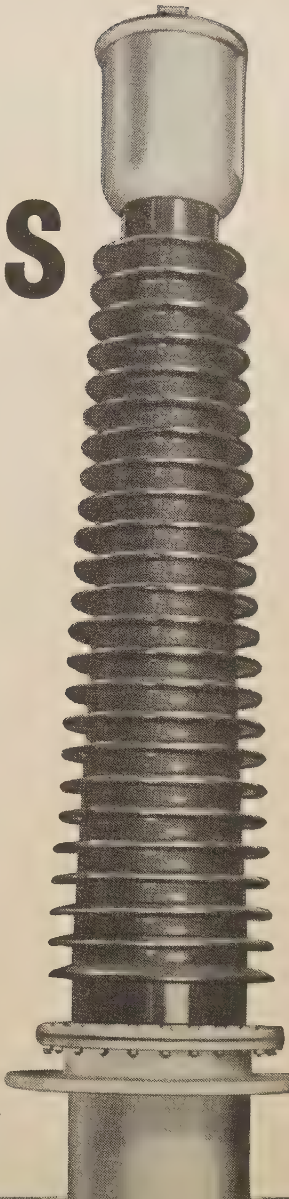
giant power

330 kV

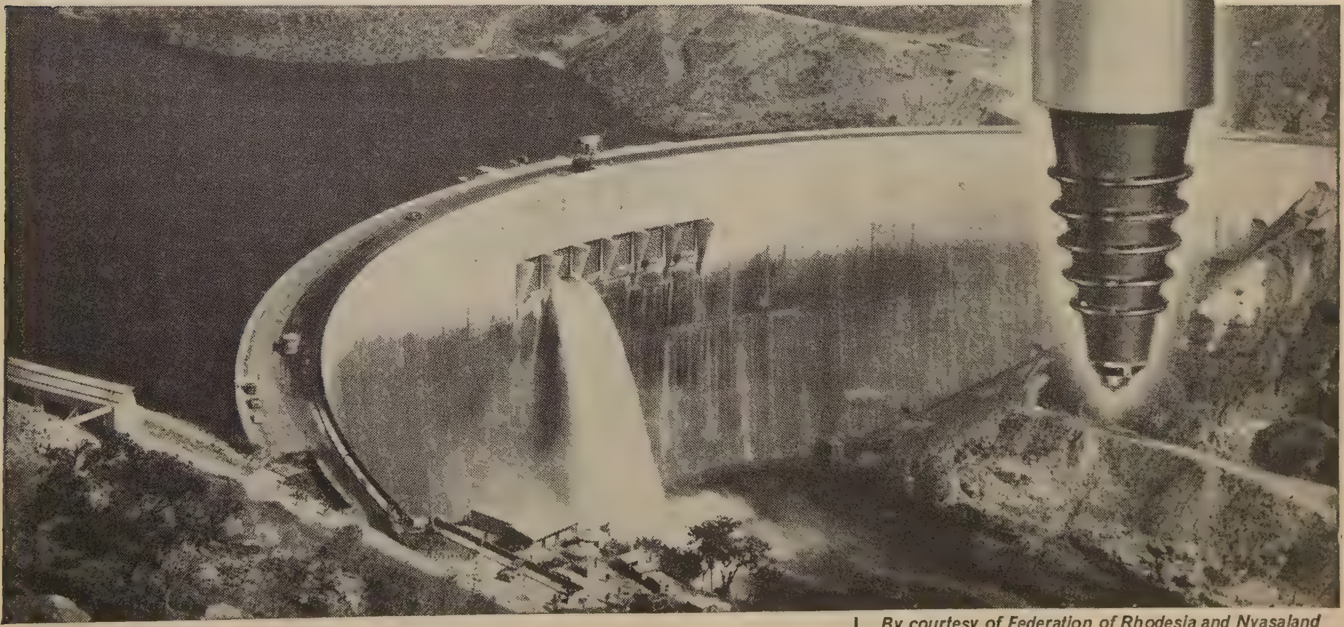
All the bushing porcelains for the 330 kV. circuit breakers, all the 330 k.V. strain insulators for the substations, and the 330 kV. post insulators for some of the substations were supplied by

BULLERS

Units of the switch gear on the south bank. Power for the Copperbelt and for Southern Rhodesia passes through this stage.



A complete 330 kV. bushing insulator (by courtesy of A.E.I. Ltd.)



By courtesy of Federation of Rhodesia and Nyasaland

BULLERS LIMITED · MILTON · STOKE-ON-TRENT · STAFFS
Telephone: Stoke-on-Trent 54321

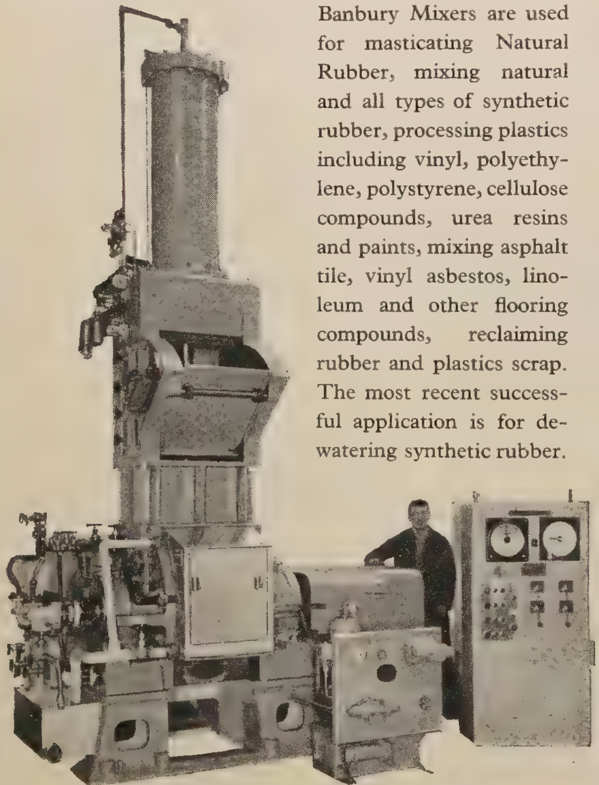
LONDON:- 6 Laurence Pountney Hill · E.C.4
Telephone: MANsion House 9971

BRIDGE

BANBURY MIXERS

David Bridge & Co. have more than 40 years experience of building Banbury Mixers, and during that period detailed design features have been constantly improved while still retaining the basic operating principles of the machine. The changes made have shortened total cycle times, improved cleanliness, reduced maintenance and increased operating efficiency generally. Material produced in a Banbury Mixer is of consistent High quality.

Banbury Mixers are used for masticating Natural Rubber, mixing natural and all types of synthetic rubber, processing plastics including vinyl, polyethylene, polystyrene, cellulose compounds, urea resins and paints, mixing asphalt tile, vinyl asbestos, linoleum and other flooring compounds, reclaiming rubber and plastics scrap. The most recent successful application is for dewatering synthetic rubber.



NEW FEATURES INCLUDE:—

Hydraulically operated drop type door, Higher operating ram pressures, Unidrive gearing, Special High H.P. high pressure Mixers, Hard Surfacing, Automatic control systems. Some of the above are optional, others are available for specific mixing requirements.

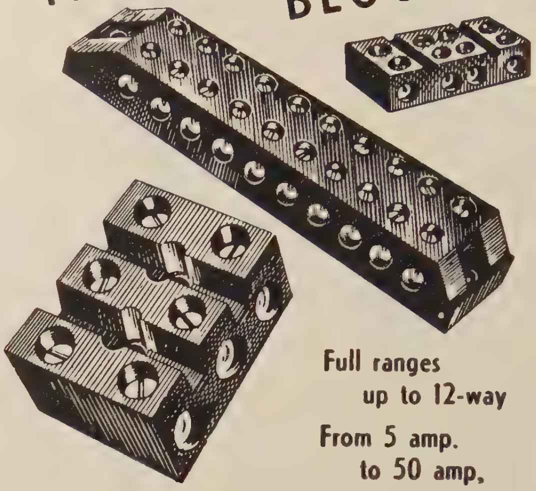
DAVID BRIDGE & COMPANY LTD.

SPECIALIST ENGINEERS TO THE RUBBER, PLASTICS, CABLE MAKING AND ASSOCIATED INDUSTRIES

Castleton Ironworks – Castleton – Rochdale – Lancs.
Phone: Castleton Rochdale 57216. *Grams:* Coupling Phone Castleton, Lancs.

London Office: 6, 7, 8 Sackville Street, Piccadilly, W.1
Phone: Regent 7480. *Grams:* Ederaceo, London, W.1

TERMINAL BLOCKS



Full ranges
up to 12-way

From 5 amp.
to 50 amp.

Litholite
Plastic Moulders since 1901

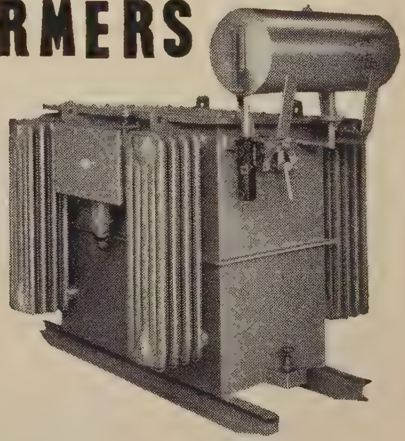
LITHOLITE Insulators & St. Albans MOULDINGS LTD.
Sandown Road, WATFORD, Herts. Tel. WATFORD 23377

Sturdy

TRANSFORMERS

UP TO
250 KVA

ALL TYPES



Also

- **POWER TRANSDUCTORS**
  for "finger-tip" manual or automatic control of power up to 300 KVA (1-phase) and 750 KVA (3-phase).
- **TRANSFORMER/RECTIFIER SETS**

STURDY ELECTRIC CO. LTD.
HAMSTERLEY COLLIERY, NEWCASTLE UPON TYNE
Telephone: Ebchester 271-272. Telegrams: Sturditran, Newcastle upon Tyne

RENOLD

extends stock drive range...

... *by the introduction of*

·625″ pitch simple chain drives to transmit up to 16 h.p. and 2,200 r.p.m.

These new drives which are available in 21 ratios between 1:1 and 6:1 offer savings in cost and space and are ideal for 5 to 15 h.p. electric motor and medium speed oil engine drives in

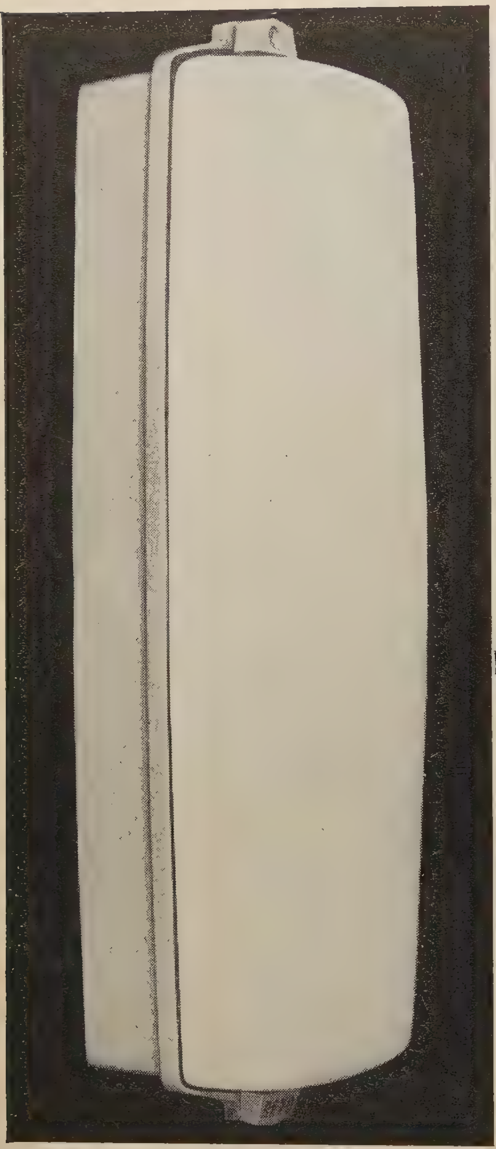
- Agricultural Machinery
- Concrete Mixers
- Conveyors
- Food Processing
- Hoisting Appliances and Winches
- Machine Tools
- Textile Machinery
- Vehicle Auxiliary Drives

Write for leaflet Ref 316/536 giving full details

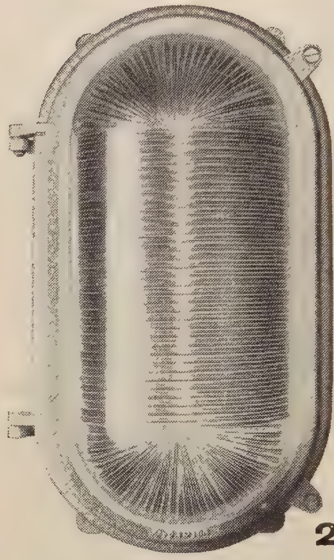
The complete range of Renold stock drives covering requirements up to 140 H.P. now totals 260

RENOLD CHAINS LIMITED · MANCHESTER

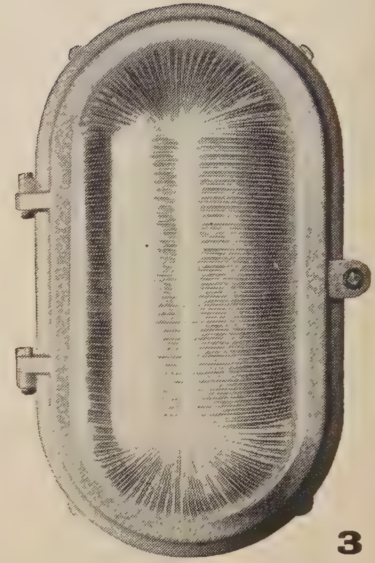
BULKHEAD &
FITTINGS BY



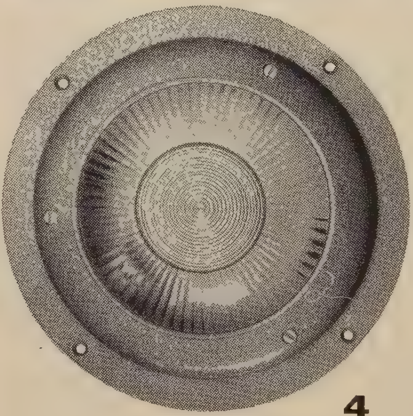
1



2



3



4

5

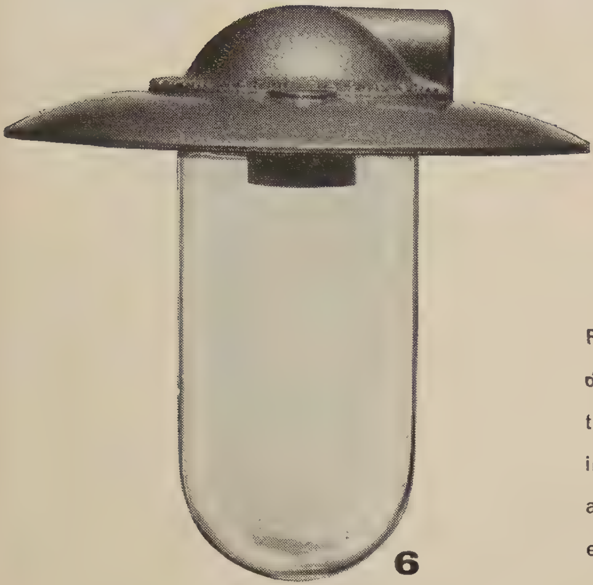
The Revo range of high quality Bulkhead fittings is designed to operate in all kinds of adverse weather conditions for long periods and with a minimum of maintenance. Selected from this range are: 1. Fluorescent Bulkhead for 12″ tubes (one, two or three) with acrylic plastic cover. 2. Aluminium and 3. Cast Iron Bulkheads (the latter galvanised if required) for 150 watt lamps. Prismatic glass covers. 4. Recessed and 5. Surface mounted "Silver Ring" Bulkheads. Choice of opalescent, or axial or symmetric prismatic glass fronts. All are finished in hammered grey stove enamel. Our illustrated leaflet gives full information.

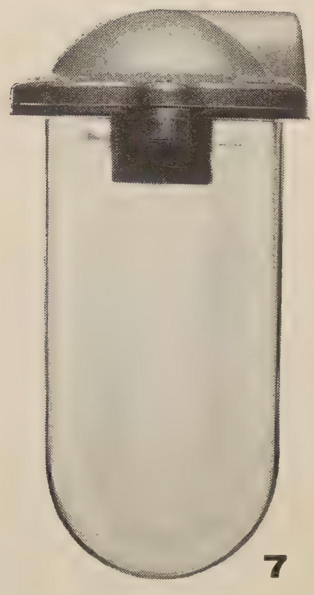
REVO ELECTRIC CO. LTD., TIPTON, STAFFORDSHIRE

A Duport Company famous for cookers, fires, fluorescent and industrial light fittings, street lighting, switch and fusegear, etc.

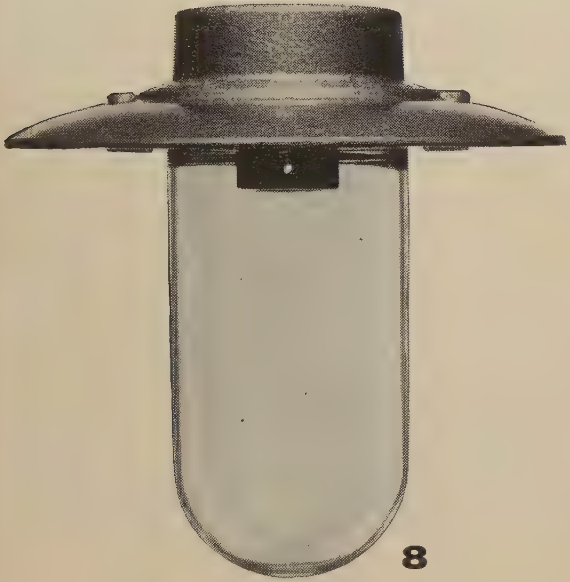
WELLGLASS

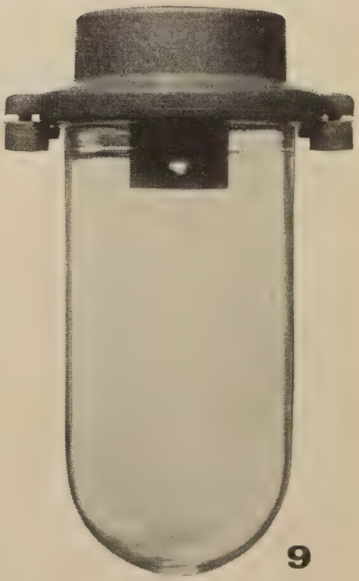
REVO ELECTRIC


6


7

Four standard fittings (Nos. 6, 7, 8 and 9) are illustrated on this page and each is available in either Die-cast aluminium alloy or cast iron, Stove enamel hammered grey finish or galvanised cast iron. Clear wellglass is mounted on a rubber seating washer and is located by two fixing lugs designed to allow removal of glass without detaching screws. 40, 60 or 100 watt tungsten lamps are suitable for these fittings. Wire guards and matching backplates and brackets are available if required. For full details refer to our leaflet which is obtainable from the address below.


8


9

*Branches at:—*LONDON *30 Gt. Queen St., Kingsway* GLASGOW *345 St. Vincent St.* MANCHESTER *Revo House, Parsonage* LEEDS *36 Park Cross St.* CARDIFF *Revo House, Frederick St.* NEWCASTLE *22 Eldon Square* BRISTOL *19 Portland Square* BELFAST *9 College Court* DUBLIN *39 Lower Gardiner St.*

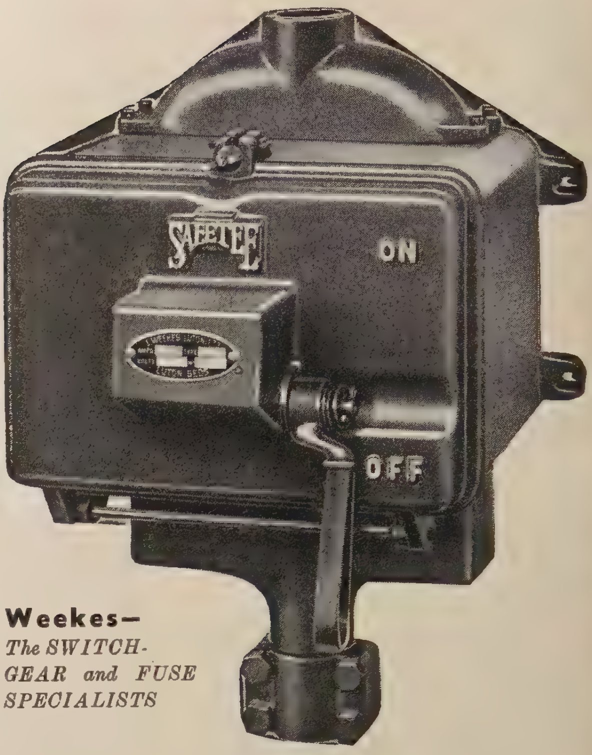
W & W 89

Weekes

'SAFETEE'
combined switchfuse with interlocked plug

- ★ Standard rating up to 500 amps, 500 volts A.C. or D.C.
- ★ Totally enclosed, watertight or weatherproof to order.
- ★ Quick break.
- ★ Fully interlocked.
- ★ Cartridge Fuses.
- ★ Cable entries as required.

Full details on request from :



Weekes—
The SWITCH-GEAR and FUSE SPECIALISTS

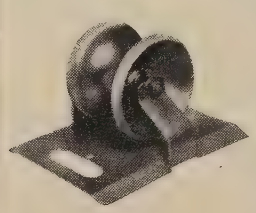
L. WEEKES (LUTON) LIMITED

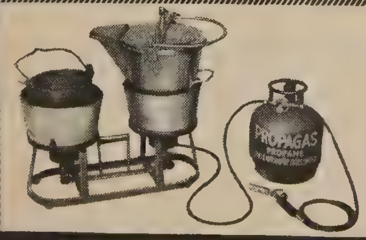
WINGATE ROAD • LUTON • BEDS
Tel.: LUTON 51478 *Grams: "SAFETEE, LUTON"*

Sheen Cable jointing EQUIPMENT

Sheen manufacture everything for the Cable Jointer including furnaces, buckets, pourers and pots.

CABLE ROLLERS
Designed to give long trouble-free service even in the most hazardous conditions. Extremely robust and free running.





GAS FURNACES
A complete range is produced to meet all requirements of Local Authorities and Main Contractors. Sound design and robust construction.

Details from
SHEEN
(Nottingham) LTD.,
Greasley Street,
Bulwell, Nottingham.

SHEEN RECOMMEND **PROPAGAS**
AS SUPPLIED BY
SHELL-MEX AND
B.P. GASES LIMITED
Cecil Chambers, 86 Strand, London, W.C.2.

The APPELBE "BULB FIXER"

NO LADDERS REQUIRED
Telescopic appliance for fixing and removing electric bulbs. Any reasonable height can be reached.
Made of Aluminium and can be carried with ease on any cycle.

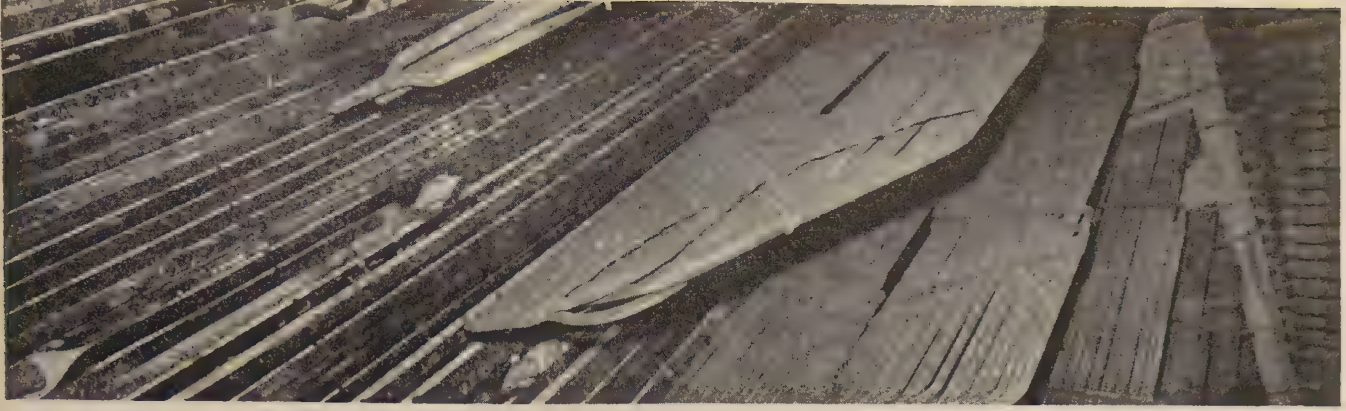
STANDARD MODEL
for 60 to 200 watt lamps at 16′ 6″ from ground. 6′ 0″ closed. 12′ 0″ extended. Weight 3lb. Cycle clips and Extension Tubing supplied.

"A" MODEL
for 200 to 500 watt lamps E.S. Caps at 20′ 0″ from ground. 7′ 0″ closed. 16′ 6″ extended. Weight 5½lb. Cycle clips and Extension Tubing supplied.

Used by the leading corporation and electric light companies throughout the world. Prices and particulars on request. Carriage Paid in Great Britain.

SAVES TIME LABOUR MONEY

J. F. APPELBE & CO. LTD.
GREAT UNION STREET, HULL
Telephone 31660 (2 lines). *Telegraphic Address "Appelbeco, Hull"*



Tubes for power at Padiham

More than 55 miles of tubing will be built into the 120MW re-heat boiler unit being constructed by Simon-Carves at the Padiham 'B' Power Station of the Central Electricity Generating Board. 860,000 lb per hour of steam will be generated at 1600 p.s.i. and 1010°F. with re-heat to 1005°F.

The furnace will be of the continuous slagging type which will convert the ash and dust into a hard, granular substance easily handled for disposal.

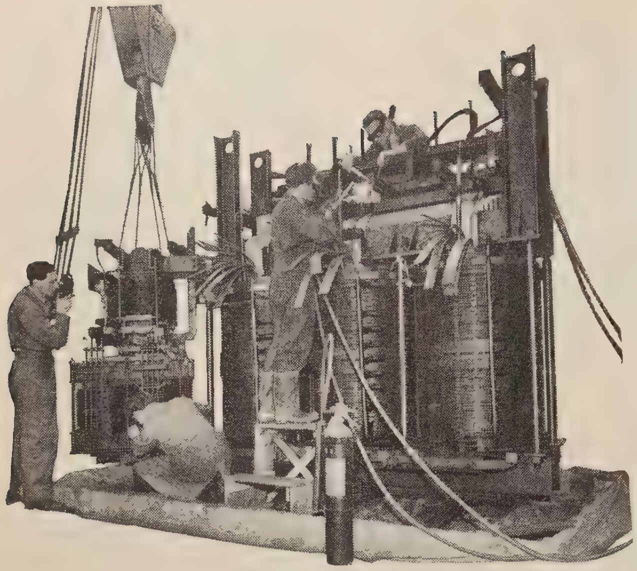
Simon-Carves water-tube boiler design is based on practical research and their vast experience of steam raising projects. Natural — or forced-circulation boilers can be supplied, with or without continuous slagging furnaces. May we send you more information ?

Simon-Carves Ltd SE

MEMBER COMPANY SIMON ENGINEERING LTD

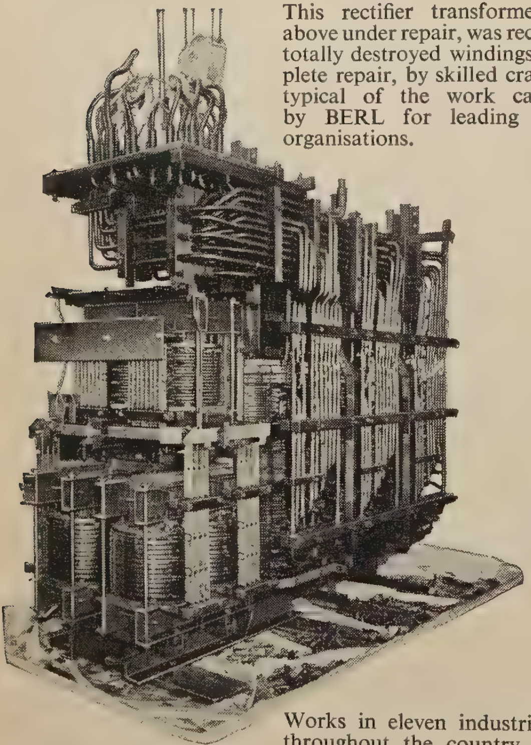
STOCKPORT, ENGLAND · and at CALCUTTA · JOHANNESBURG · SYDNEY · TORONTO

SC269/PS



Transformation from a burnt-out shell!

This rectifier transformer, shown above under repair, was received with totally destroyed windings. Its complete repair, by skilled craftsmen, is typical of the work carried out by BERL for leading industrial organisations.



Works in eleven industrial centres throughout the country provide a complete, A.C. and D.C. electrical repair service including rewinding on site. Whatever the breakdown, call your nearest BERL works for prompt, on-the-spot attention.

B.E.R.L.

British Electrical Repairs Limited

Head Office:— Empire House · Charlotte Street · Manchester I
Telephone: CENtral 1378 and 3641.
Works at :— Bath · Birmingham · Cardiff · Chesterfield · Edinburgh Glasgow · Hawick · London · Manchester · Newcastle upon Tyne · Swansea

BER 139

MERCURY SWITCHES

THE MERCURY SWITCH MANUFACTURING COMPANY LIMITED are the largest specialised manufacturers of Mercury Switches in Great Britain. These are made to exceptionally high and uniform standards of quality.
Since its inception in 1932, this Company has concentrated solely on the production of Mercury Switches. It has thereby obtained the widest possible experience and expert knowledge of design, manufacture and application.

THE MERCURY SWITCH
MANUFACTURING CO. LTD.
WEST DRAYTON - MIDDX.
West Drayton 2291-3

MS11

If you need

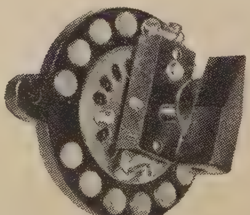
a small **METAL PRESSING** for your product, why not consult us?

We specialise in light precision presswork in all metals for the Electrical Trades.

QUOTATIONS BY RETURN

BIRMINGHAM SPECIALITIES LTD.
Moor Lane, Witton, Birmingham 6. *Phone: BIRchfields 5026*

NEW!!



15-WAY ROTARY SWITCH

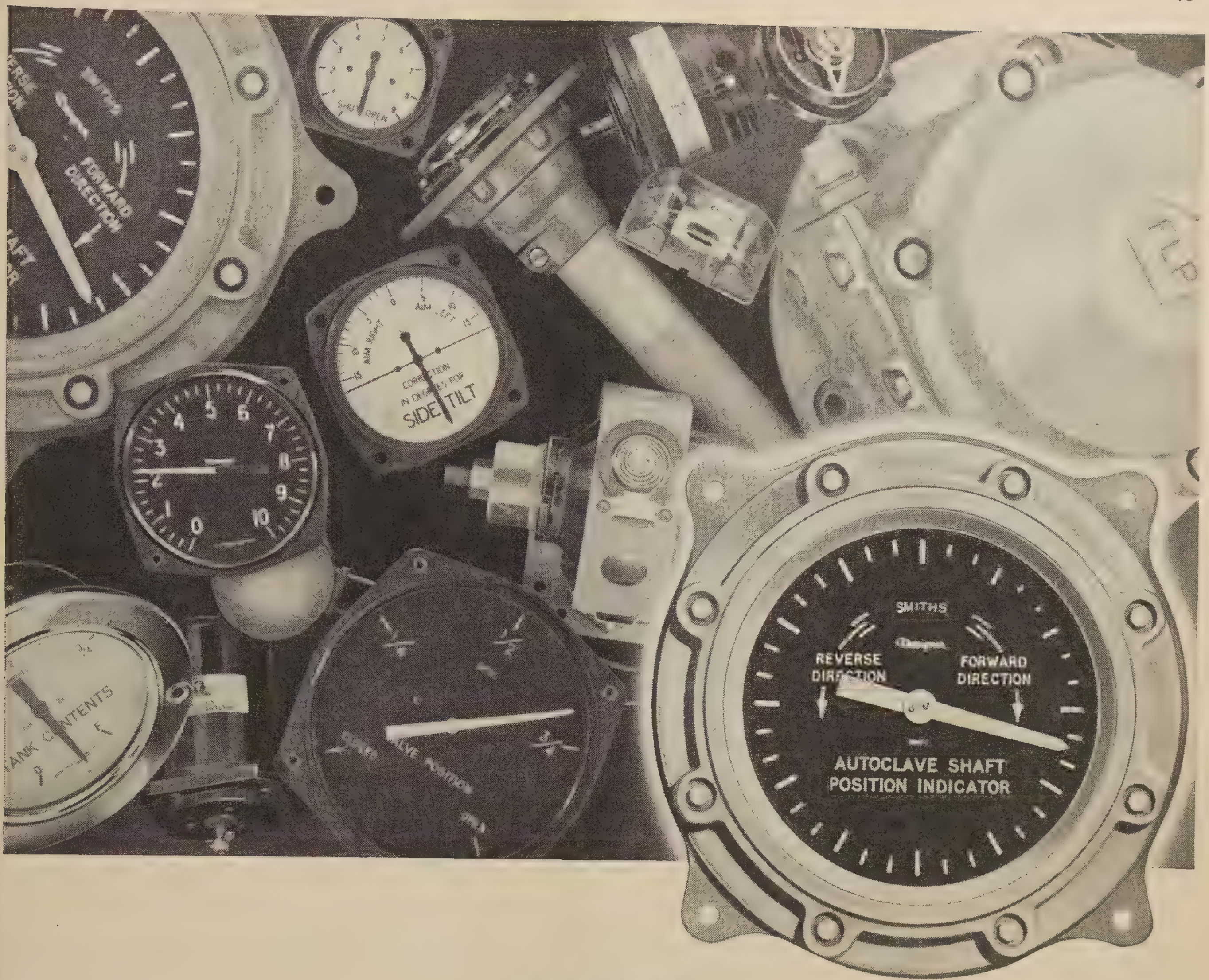
Adjustable from 1 to 15 way

THE SWITCH for Transformer Tapping Control

15 amp – 30 amp
S.P. – D.P. – T.P.

Phone : Kings Norton 1604

HENLEY BURROWES & CO. LTD.
Factory Centre KINGS NORTON, BIRMINGHAM



angle on SMITHS

Such functional information as angular position, fluid level, force, linear position, pressure and differential pressure can be transmitted electrically to one or more remote observation points by means of SMITHS 'Desynn' System.

Smooth and stepless pointer indication provides an instant, accurate reading. Inset above is SMITHS 'Desynn' 6-inch Flameproof Indicator, calibrated to register autoclave position. This equipment has been tested by the Ministry of Fuel and Power, and passed for use in dangerous atmospheres such as pentane, hexane, butane, acetone, coal gas and coke oven gases. We will gladly send a Technical Representative to give you all the 'angles' on the capabilities and applications of SMITHS 'Desynn' System of Remote Indication.

SMITHS INDUSTRIAL DIVISION

The Industrial Division of **S. Smith & Sons (England) Ltd**

Kelvin House Wembley Park Drive Wembley Middlesex Phone Wembley 8888

DI

1908 — **53 YEARS** — 1961

OF RELIABLE SERVICE IN THE DISTRIBUTION

of

EVERY DESCRIPTION

of

ELECTRICAL MATERIAL

for

EVERY SITUATION

We Handle High-Class Material Only

Our Addresses :

Liverpool :
1-17 Stanley Street
Telephone : Central 5491
(10 lines)

Manchester :
72 Chapeltown Street
Telephone : ARDwick 5292
(4 lines)

Carlisle :
Paternoster
Row
Telephone : 26231-2

Birkenhead :
94 Chester Street
Telephone : 6451
(3 lines)

Workington :
Oxford Buildings
Oxford Street
Telephone : 2739

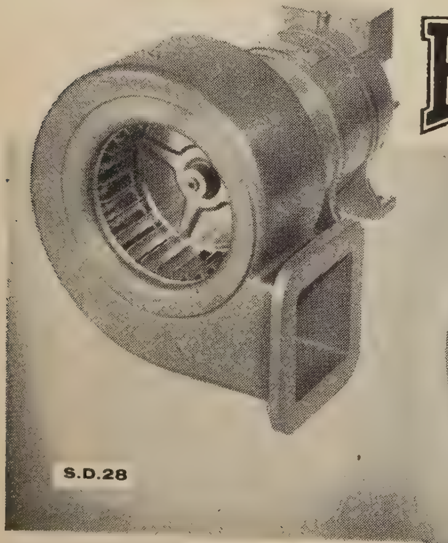
DOWNES & DAVIES LTD.

3 NEW BLOWER UNITS

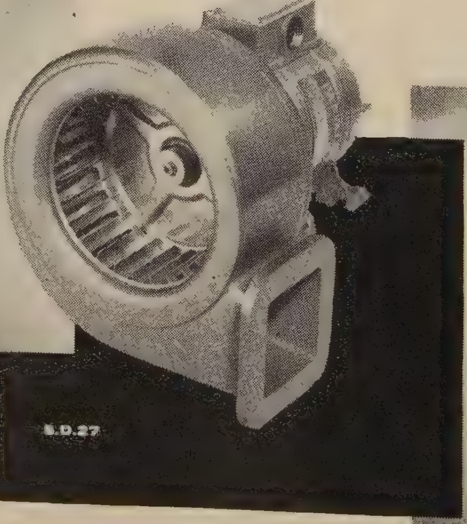
FROM

PARVALUX

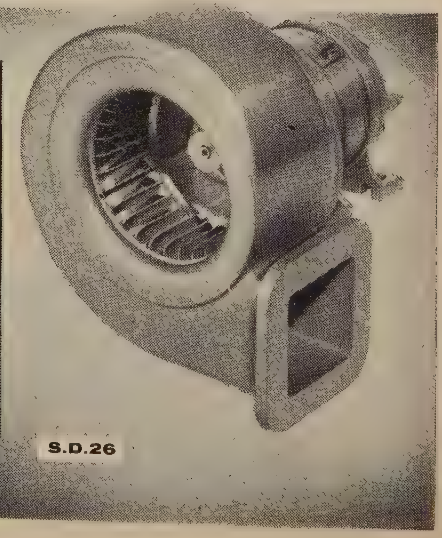
Totally enclosed frames – Class 'E' installation. All standard voltages · Built to B.S.S. 170 · Outputs up to 260 C.F.M.



S.D.28



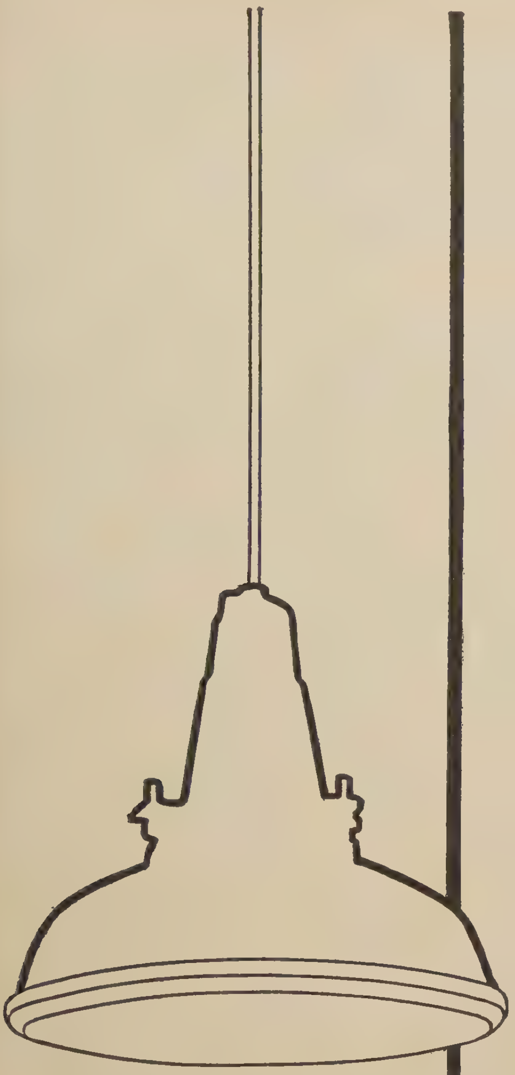
S.D.27

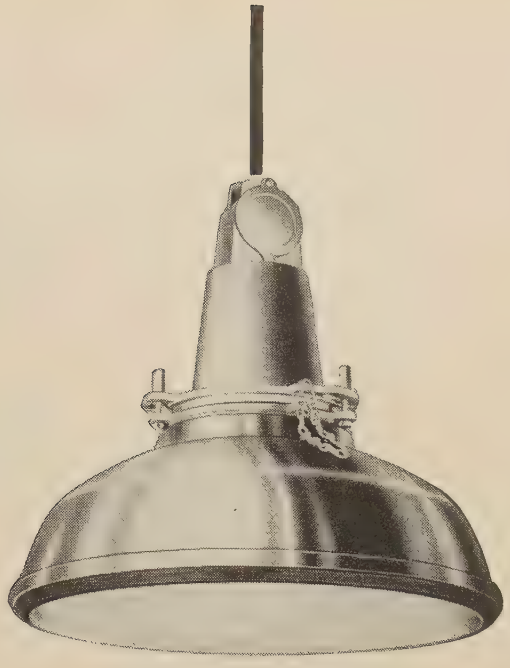


S.D.26

REGISTERED TRADE MARK
PARVALUX

FULLY ILLUSTRATED LITERATURE FROM
Parvalux Electric Motors Limited (E.R.), Wallisdown Road, Bournemouth, Hampshire
Tel: Winton 4983/4
Grams: Parvalux, Bournemouth





New

DUST PROOF

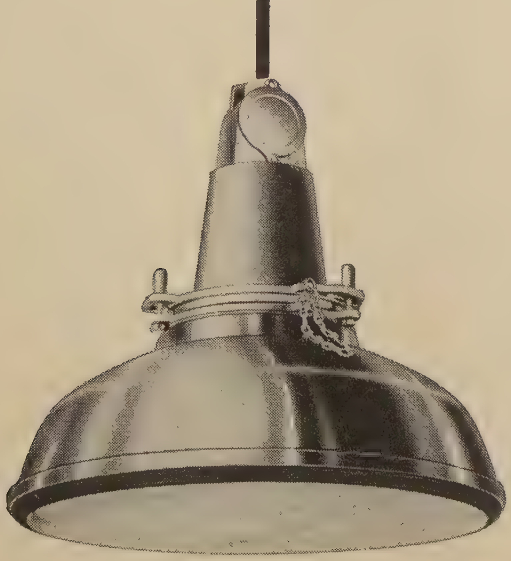
THOROSEAL

LIGHTING UNITS

make it easy to keep your lights clean. Hose the grime off without fear of water penetration. Smooth surfaces and sealed in toughened glass exclude all dust, vapours and fumes.

- ★ Integral cool mains connection box.
- ★ Quick release catches for relamping.
- ★ External accessories in Stainless Steel and corrosion resistant Cast body.
- ★ Easy maintenance and cleaning.
- ★ Available for a wide range of filament or mercury vapour lamps.

Contact F. W. Thorpe Ltd for full details.



Thoroseal makes light work in a dirty atmosphere.

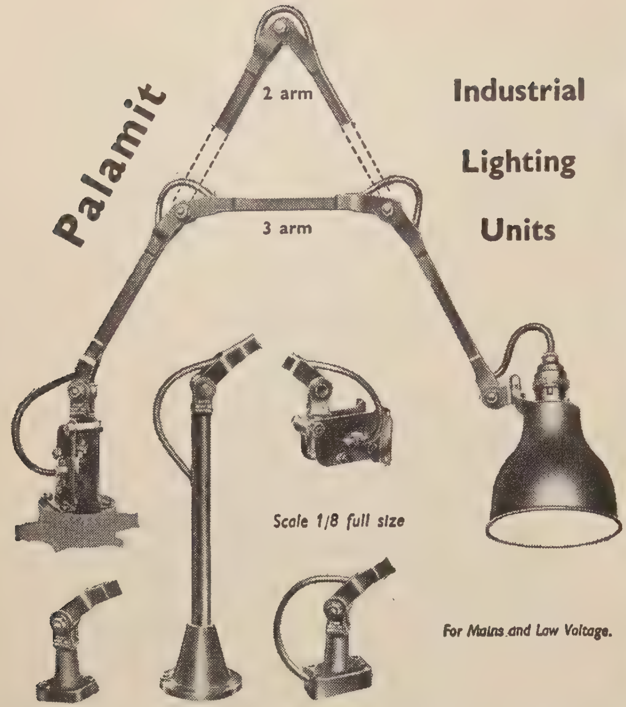
Write for your copy of our new catalogue No. 1067

THORLUX
REGD
THROWS LIGHT ON INDUSTRY

F. W. THORPE LTD · Welby Road, Hall Green, B'Ham 28
Telephone: SPRingfield 3318-19-20 · Grams: Thorlux B'ham

Palamit

Industrial Lighting Units

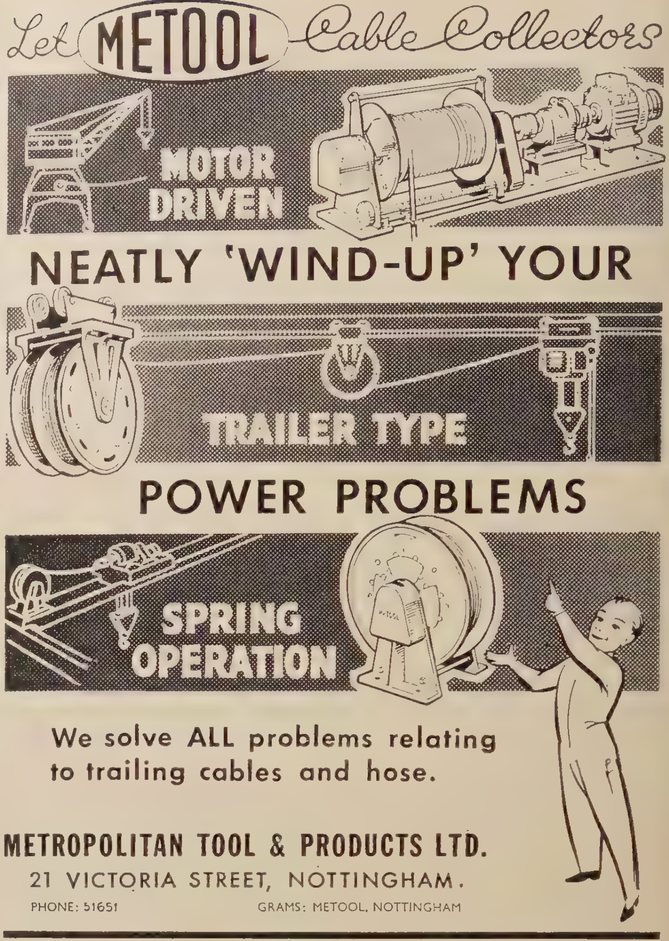


Palamit units are for use where the advantages of **MEKELITE** units have to be sacrificed to the consideration of low first cost. The difference in price is due to the simplified design and not to lower standards of material and workmanship.

Various arm lengths (max. horizontal reach 39 in.). Five sizes of reflector. Seven types of base. *Full particulars on request.*

MEK-ELEK Eng. Ltd., Western Rd, Mitcham, Surrey
Phone: MITcham 3072 Cables: Mekelek, London

Let METOOL *Cable Collectors*



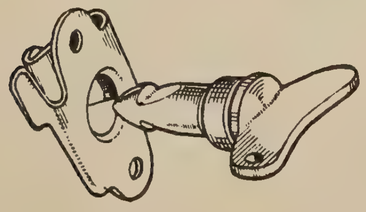
NEATLY 'WIND-UP' YOUR

POWER PROBLEMS

We solve ALL problems relating
to trailing cables and hose.

METROPOLITAN TOOL & PRODUCTS LTD.
21 VICTORIA STREET, NOTTINGHAM.
PHONE: 51651 GRAMS: METOOL, NOTTINGHAM

ODDIE
FASTENERS



The Fastener with endless applications.
Simple, Positive, Self-locking. Made
in a variety of types and sizes.

Special Fasteners to suit customers' requirements

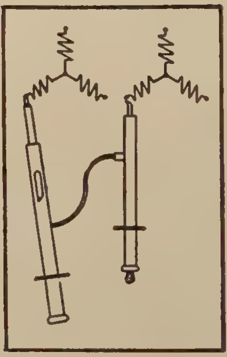
WIDELY USED IN THE ELECTRICAL AND
RADIO INDUSTRY

Department "E.R."

ODDIE, BRADBURY & CULL LTD.
SOUTHAMPTON
Telephone 55883 *Cables: "Fasteners, Southampton"*

IN PHASE?

'WESTMINSTER'
PATENT PHASING DEVICES
WILL TELL....

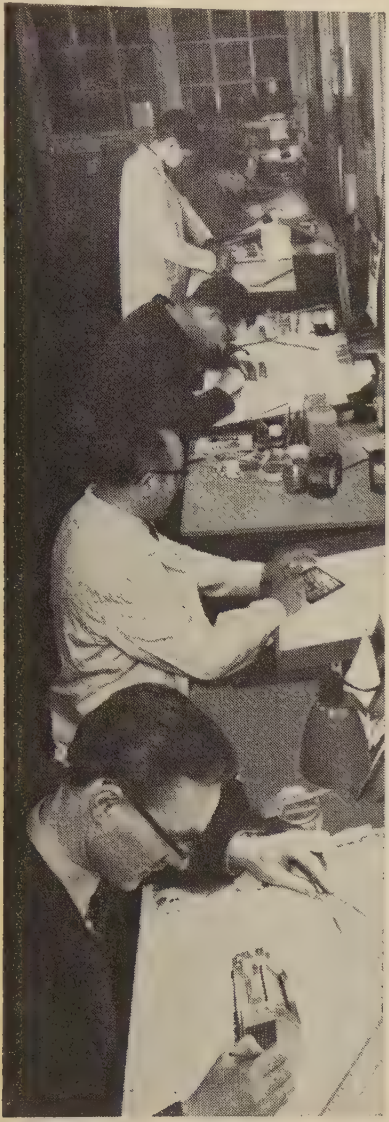


Used to locate interconnection between two A.C. systems. For voltages up to 11Kv. New model approved by Central Electricity Safety Committee.

Made by the manufacturers of Westminster and Partridge H.V. Detectors

Write for full particulars to:—

The WESTMINSTER ENGINEERING Co Ltd
(Dept. H1), Victoria Road, Willesden Junction, London NW10
Tel.: ELGar 7372/3



everybody's
warm
with...

Florawarm

In the office, workshop, home or factory, Florawarm installations provide the perfect solution for efficient background heating.

The capital outlay for a complete Florawarm heating system is surprisingly low . . . . the installation simple . . . . and the running costs reasonable.

Florawarm also provides an effective storage heating system which takes full advantage of "off peak" tariffs.

Florawarm Cable is used by Electricity Boards and the main electrical and building contractors throughout the country.

"FLORAWARM" is the Registered Trade Mark of Wandleside Cable Works Ltd. The manufacture and sale of "FLORAWARM" Cable is fully protected by British Patent No. 865055 and others in all parts of the world. "FLORAWARM" cannot be imitated.

WANDLESIDE · CABLES

WANDLESIDE CABLES

In Association with: IRISH CABLES LTD.
WANDLESIDE WARREN WIRE CO. LTD. &
WANDLESIDE NATIONAL CONDUCTORS LTD.

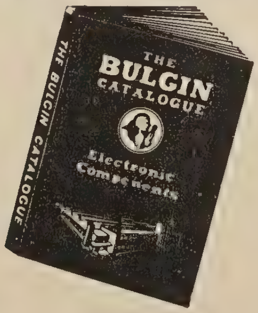
WANDLESIDE CABLE WORKS LTD., 106 GARRATT LANE, WANDSWORTH, LONDON, S.W.18
Tel: VANdyke 7544 (7 lines) *(in FALKS Group)* *Teleg: Wandleside London S.W.18*

THE

"THE CHOICE OF CRITICS"

BULGIN

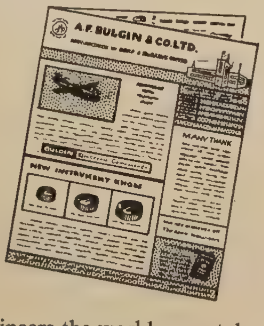
ELECTRONIC COMPONENTS CATALOGUE AND BULLETIN



Our 175 page catalogue published in OCTOBER 1961 contains illustrations, full working details and dimensions of over **10,000 Electronic Components** and included are the new lines and developments announced during the past year.

Send for your copy now, available free on request to all manufacturers and Electronic Engineers who have not already applied.

QUOTE REFERENCE 202/B



Electronic Engineers the world over, take the opportunity of receiving month by month our fully illustrated Electronic Components Bulletin.

Keeping them up-to-date with the latest developments and additions to the extensive range of Electronic Components manufactured by the House of Bulgin.

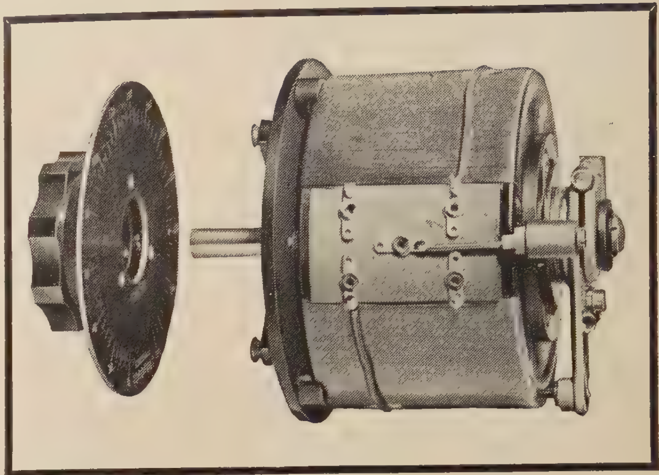
If you wish your name to be included on our Mailing List, write, attaching **Trade** or **Professional Letterhead** to the address shown below.

MAILING DEPARTMENT **BYE-PASS ROAD, BARKING, ESSEX**
A. F. BULGIN & CO. LTD. Telephone: RIPpleway 5588 (12 lines)

---

expamet | cressall

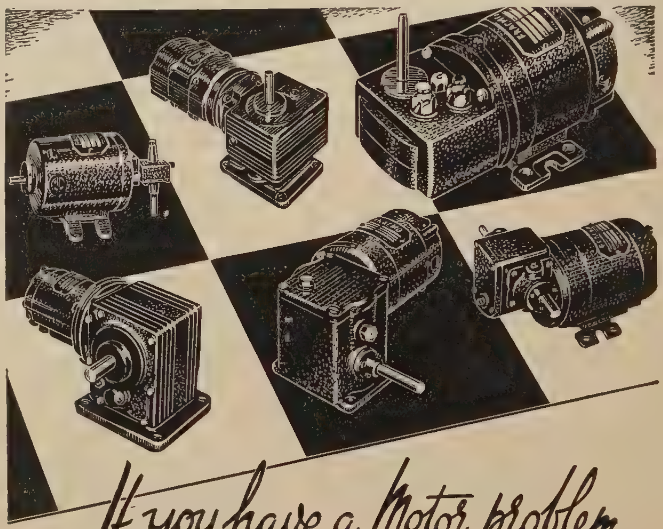
TOROVOLTS



A range of continuously variable auto-transformers of exceptionally robust and reliable design. Provide smooth adjustment of A.C. voltages from Zero to 20% in excess of supply.

expamet | cressall

THE CRESSALL MANUFACTURING COMPANY LIMITED
Cheston Road · Birmingham 7 **Telephone : EAST 3571**
London Office: 16 Caxton Street, S.W.1 · Telephone: ABBey 7766
Electrical Division of The Expanded Metal Company Limited



If you have a Motor problem

Get in touch with our Technical Staff they will be pleased to help

FRACMO MOTORS

Models illustrated are just a few geared units from our vast range, providing output speeds from 0·125 r.p.m. to 590 r.p.m. against torque loadings from a few oz./in. up to 350 lb./in.

FRACTIONAL H.P. MOTORS LTD.
Rookery Way, London, N.W.9. **Phone: COLindale 8022-3-4**
Midland Agent: Law & Plumtree, Dale Buildings, Dale Rd., Matlock, Derbyshire Telephone: Matlock 326
Northern Agent: P. A. Bennett, 29 Hollins Drive, Sheffield 6. Tel.: Sheffield 345967

DaF151261 ER

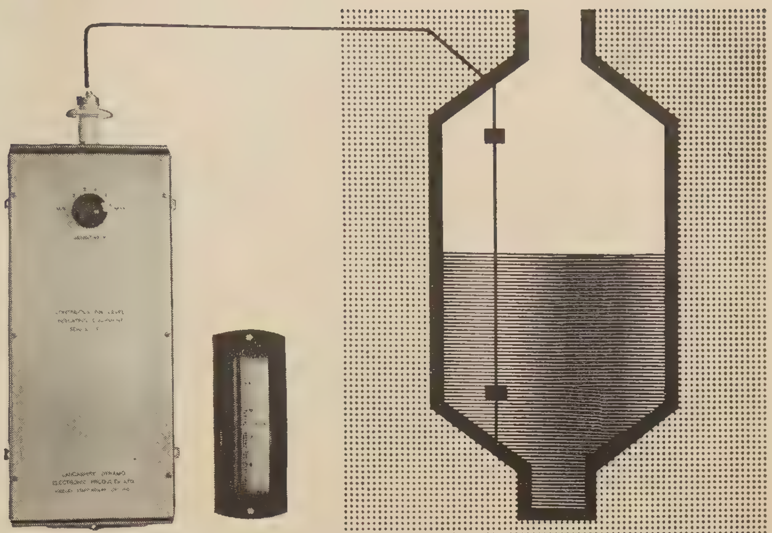
AT EVERY LEVEL...

Quantimeter

A NEW CONCEPT IN 'LEVEL' MEASUREMENT

- Automatic compensation against changing dielectric loss . . .
- Particularly suited for application to granular and powder materials . . .
- Errors due to variable moisture content substantially reduced.

Publication D11011 gives full details.

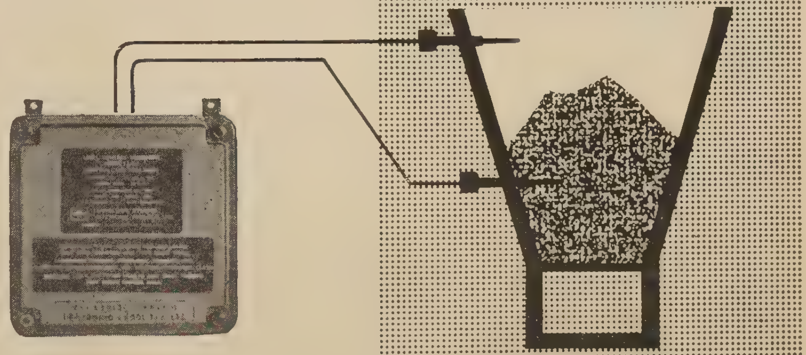


TLC

CAPACITANCE OPERATED LEVEL SWITCHES

- Fully transistorised operation . . .
- Intrinsic safety certification (IS3086) . . .
- Unlimited distance between probes and control unit . . .
- Fail-to-safety operation . . .
- Single and multipoint facilities . . .
- A range of probes to suit all applications.

Publication D22011 refers.

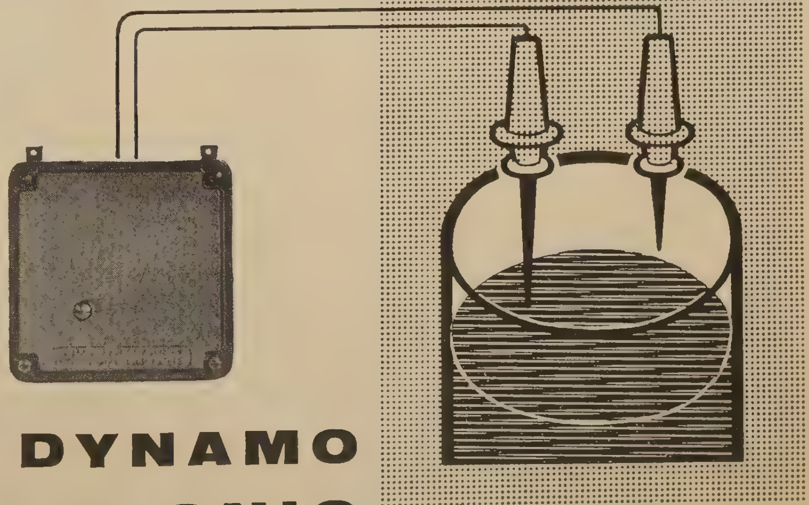


Autodip

FOR LIQUID LEVEL

- Simple in concept . . .
- Easy to install . . .
- Rugged and reliable . . .
- Suitable for a wide range of liquids.

Details provided in publication D22012



**LANCASHIRE DYNAMO
ELECTRONIC
PRODUCTS LIMITED**

RUGELEY · STAFFS

Group

SP.21

BKS

AUTOMATIC STATOR ROTOR STARTERS

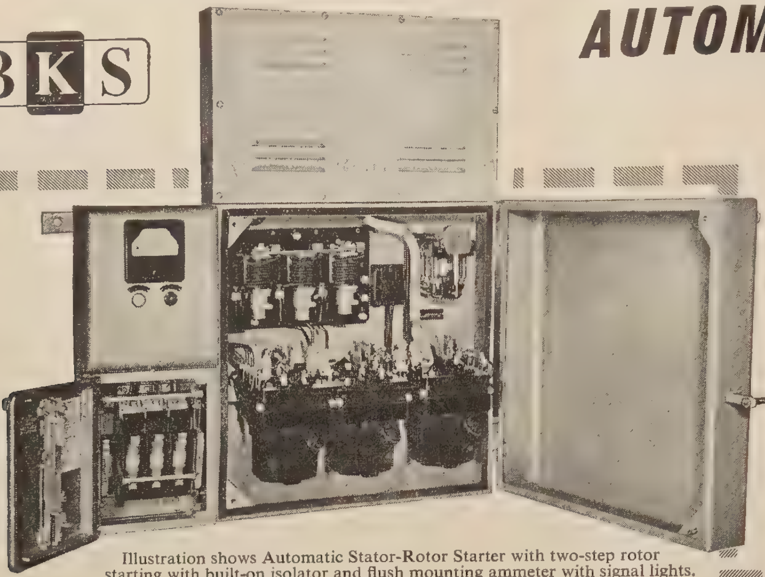


Illustration shows Automatic Stator-Rotor Starter with two-step rotor starting with built-on isolator and flush mounting ammeter with signal lights.

This range of automatic stator-rotor starters is suitable for controlling slip ring motors up to 40 h.p. on 380/440 volts, three-phase supply, and utilised in their construction are our now famous heavy duty contactors, which are fitted with solid silver contacts, air-break; the solenoid assembly only is oil-immersed, but NO MAINTENANCE IS REQUIRED. This unique design prevents contact bounce by controlling the speed of the contact make and break, thereby increasing the contact life considerably. No other contactor has this feature.

POST THIS COUPON *TO-DAY!*

BRITISH KLOCKNER SWITCHGEAR LIMITED

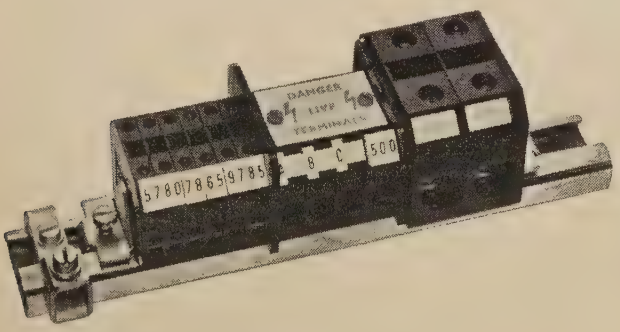
Head Office and Works: **CHERTSEY, SURREY.** Tel: Chertsey 3467 Grams: Switchgear, Chertsey.

SALES OFFICES

LONDON: Refer to Head Office.
MANCHESTER: Cromford House, Cromford Court, Manchester 4. Tel : BLAckfriars 3903.
GLASGOW: 73 Robertson Street, Glasgow C.2. Tel : CENtral 2479.
NEWCASTLE: Mr. H. Breeze, 4 Beechwood Avenue, Monkseaton, Whitley Bay, Northumberland. Tel : Whitley Bay 24231.
WEST MIDLANDS: 2-3 Graham Street, Birmingham I. Tel : CENtral 6693.
EAST MIDLANDS: Mr. D. A. Crossley, 38 St. Mawes Avenue, Wilford, Nottingham. Tel : Nottingham 89023.
YORKSHIRE: Mr. H. S. Parry, "Lone Stack", Holly Bush Green, Collingham Bridge, Wetherby. Tel : Collingham Bridge 134.
EIRE: McKenna Distributors Limited, 2 Ashton's Quay, Dublin. Tel : Dublin 78435
Associated Company: Hindustan Klockner Switchgear Ltd., Bombay.

To BRITISH KLOCKNER SWITCHGEAR LTD. CHERTSEY, SURREY.
Please send me your latest comprehensive catalogue.

NAME ....
POSITION ....
FIRM ....
ADDRESS ....
.... **R 58/61**



OBERTERM *All British* Control Gear Terminal Blocks

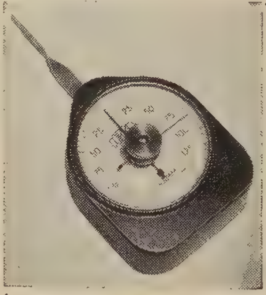
Provide the answer to many of your problems:

- Loads from 25 to 100 amp. in any order.
- Standard Mounting Rail for all sizes.
- Snap-in fixing. No special Tools required.
- High-grade Melamine Mouldings for first-class insulation.
- Special Cable Clamp design to eliminate strand breakage.
- Space saving—100—25 amp. ways in 30 inches.
- Terminal identification simply achieved.

Above are only some of the many advantages that OBERTERM Clip-in terminals offer. Details of these and other types on request.

OBERTERM ELECTRICAL CO. LTD.

Terminal Works, Kimbolton Road, Higham Ferrers, Northants
Rushden 3677
London Office: 80 New Bond St., London, W.1. Tel: Hyde Park 0728



RELAY USERS

"CORREX" TENSION GAUGES

The only instrument solely designed for accurately measuring tension on Relays, Contacts, Switchgear, and electrical apparatus of all kinds. Gauge measures in grammes, and a large range of sizes is produced to cover from 0.3-2,000 grammes.

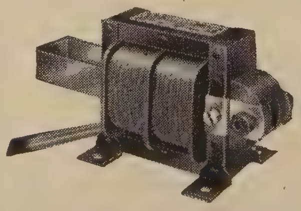
Swiss made and guaranteed.

Write for illustrations and prices from the Sole Distributors throughout the U.K.

JAMES W. CARR & CO. LTD.
Dept. SALES, 7-15, Rosebery Avenue, LONDON, E.C.I
Telephone : TERMINUS 8866 (P.B.X.)

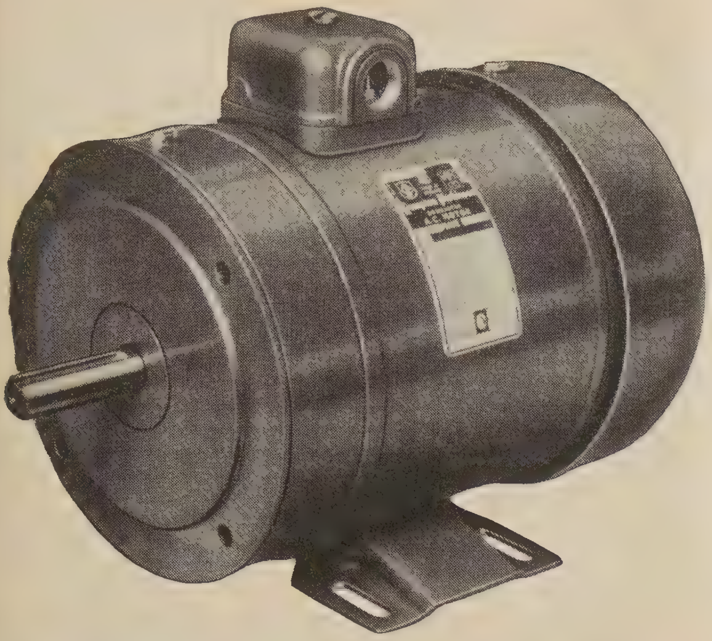
A.C. SOLENOID TYPE SBM/T

Now fitted with stainless steel guides—six times the life



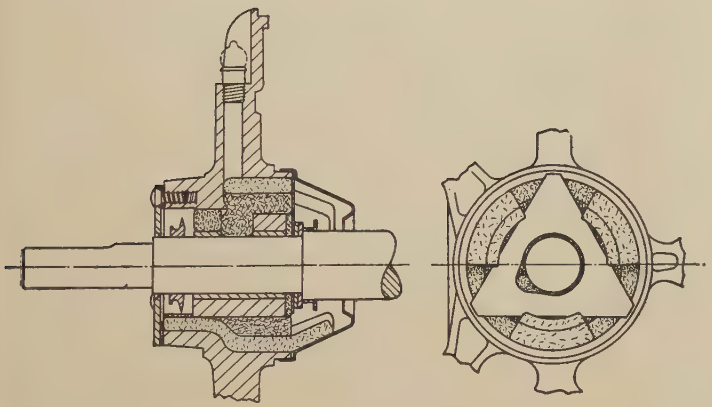
Continuous $3\frac{3}{4}$ lbs. at 1"
Instantaneous to 16 lbs.
Smaller sizes available
Also Transformers to 7 kVA 3 phase

R. A. WEBBER LTD.
KNAPPS LANE, CLAY HILL, BRISTOL 5 PHONE 65-7228/9



Most industrial motors today have ball or roller bearings; they were, in fact, standardised on C.P. motors at a time when most other manufacturers still fitted sleeve bearings. We fitted them because we realised early on that they can survive long periods without maintenance. But, on the other hand, they are noisier than good sleeve bearings properly lubricated and, in many of the places in which our F.H.P. motors are used, silence is important. What was wanted, then, was a sleeve bearing that would work with as little maintenance as a ball race. We developed the original Marathon sleeve bearing, which was quite outstanding in this respect, many years ago, and our Marathon Mark III is the result of even further improvements to that design.

This thing called know-how



This bearing is an excellent example of that part of engineering design that stems from experience rather than theory and is covered by the possibly ugly but certainly indispensable term—know-how. The oil cavity is large and filled with highly absorbent felt which, acting as a wick, circulates the oil continuously, and which also acts as an oil filter. The thrust is taken on a bakelised washer supported by a steel washer, bearing on a triangular plate of spring steel which cushions the end thrust. The thrust faces are lubricated by the felt projecting through a D-shaped opening in this plate. These bearings run silently without attention for a year or more at a time.

Crompton Parkinson
LIMITED

ELECTRICAL EQUIPMENT

Makers of Electric Motors of all kinds, A.C. and D.C. Generators, B.E.T. Transformers, Switchgear, Cables, Instruments, Lamps, Lighting Equipment, Batteries, Stud Welding Equipment, Traction Equipment, Ceiling Fans.

CROMPTON PARKINSON LTD · CROMPTON HOUSE · ALDWYCH · LONDON · WC2

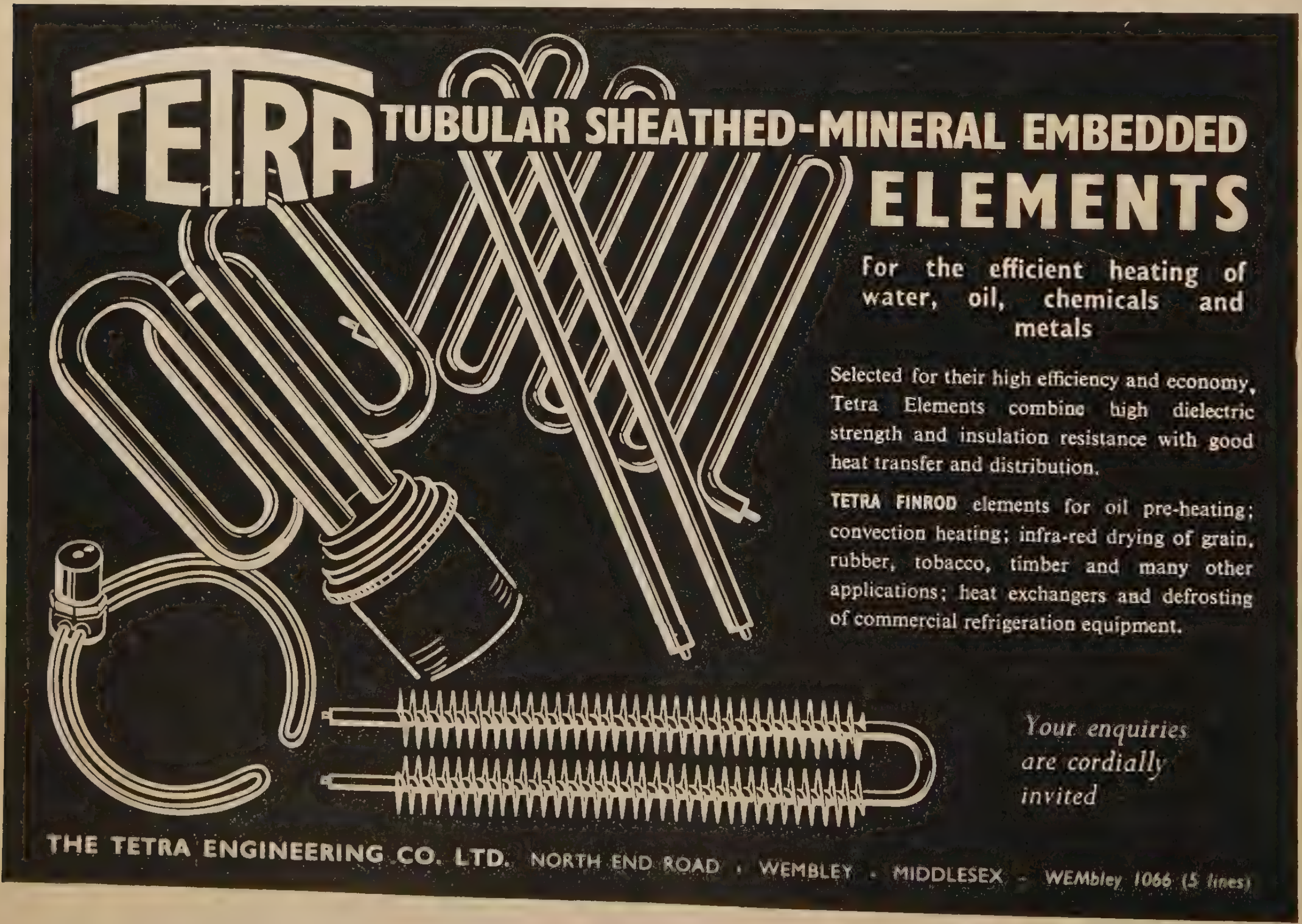
F613

Capstan and Automatic Work and Sheet Metal Pressings in any Metal, any Finish, any Quantity.

GRIFFITHS, GILBART, LLOYD, AND COMPANY LIMITED

EMPIRE WORKS,
PARK ROAD,
BIRMINGHAM, 18

TELEPHONE NORthern 6221



TETRA TUBULAR SHEATHED-MINERAL EMBEDDED ELEMENTS

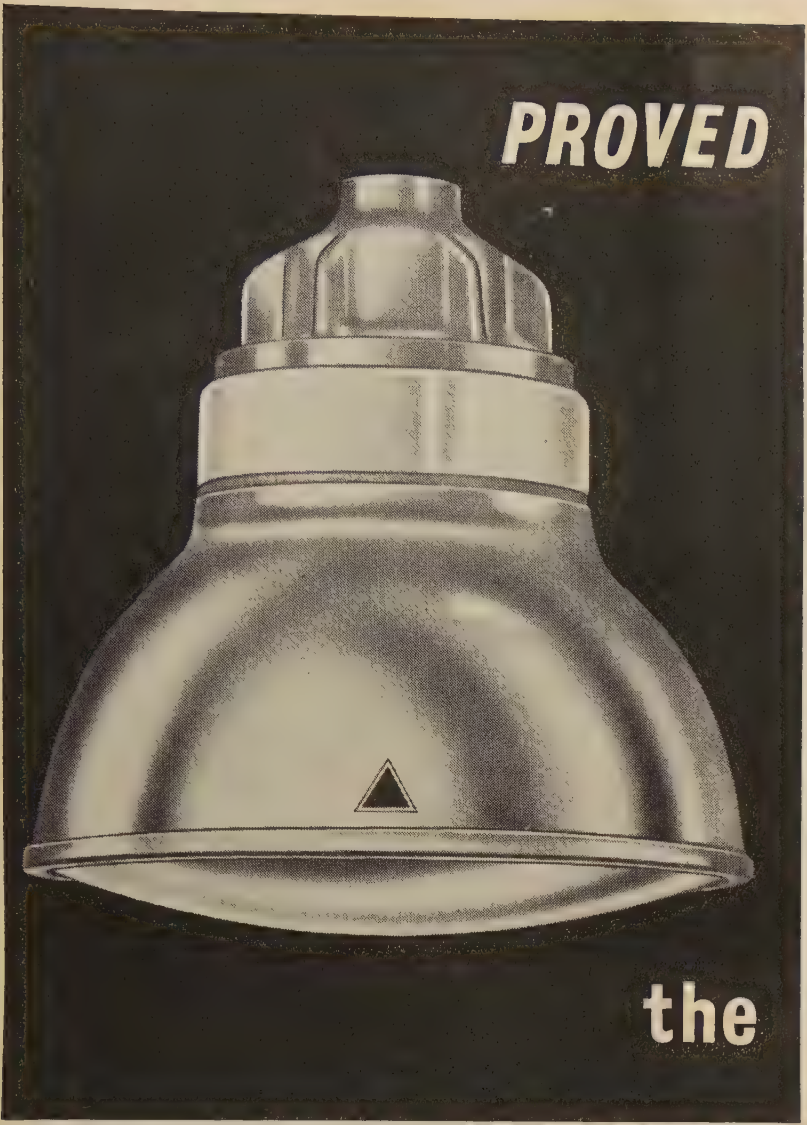
For the efficient heating of water, oil, chemicals and metals

Selected for their high efficiency and economy, Tetra Elements combine high dielectric strength and insulation resistance with good heat transfer and distribution.

TETRA FINROD elements for oil pre-heating; convection heating; infra-red drying of grain, rubber, tobacco, timber and many other applications; heat exchangers and defrosting of commercial refrigeration equipment.

Your enquiries are cordially invited

THE TETRA ENGINEERING CO. LTD. NORTH END ROAD · WEMBLEY · MIDDLESEX · WEMbley 1066 (5 lines)



PROVED UNDER THE MOST ADVERSE CONDITIONS

Now regarded as standard equipment for ANY location

the REAL

'Reflectortight'

Many industrial users who first installed " Reflectortight " Fittings for a hazardous situation now regard them as standard equipment for the whole factory. The clean (and easily kept clean) contour reduces maintenance to a minimum.

The " Reflectortight " range covers :—
80 Watt — 400 Watt MFB/U Mercury Discharge Lamps
100 Watt — 500 Watt G.L.S. Lamps.

Our Illuminating Engineering Department can offer full technical assistance for the planning of any lighting scheme.

The 'Reflectortight' embodies all the advantages of a porcelain screw-neck watertight fitting with the efficiency of a standard reflector unit. The heavy pressed glass cover is virtually unbreakable and the reflector surface maintains efficiency over very long periods.

REAL

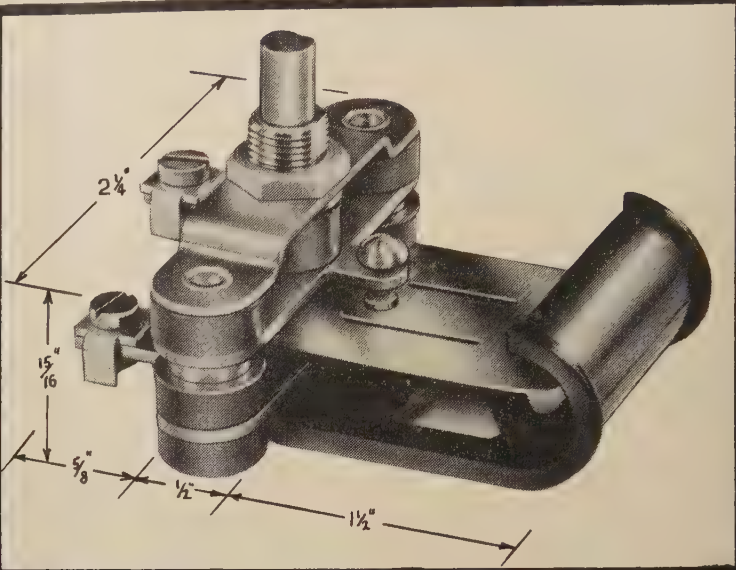
R.E.A.L. is the registered Trade Mark of:

ROWLANDS ELECTRICAL ACCESSORIES LIMITED
R.E.A.L. WORKS - BIRMINGHAM 18

The *Otter* REGD. variable control thermostat Type O MK V

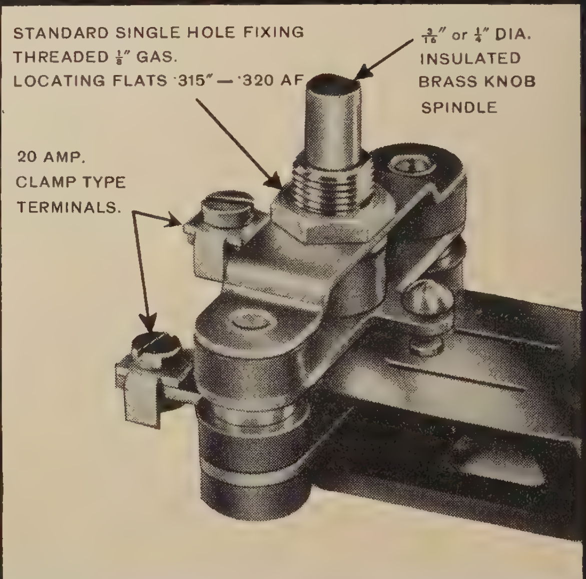
WORLD PATENTS INCLUDING PATENT NUMBERS 600055, 622781, 624905, 657434, 713443, 749716, 774911, 782668 AND OTHERS. ALSO OTHER PATENTS PENDING.

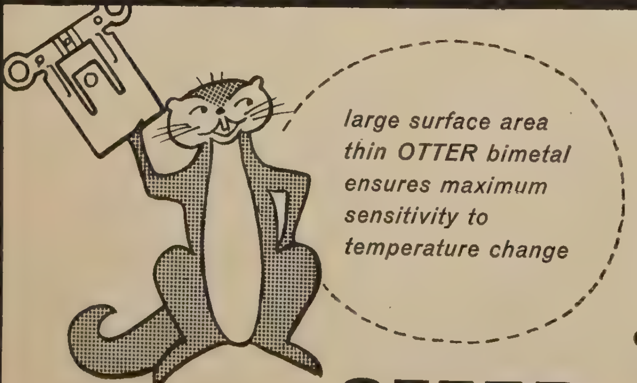
life tested
to over
120,000 complete
operations at
20 amps 250 volts AC
- and
still going strong



FEATURES

HIGHLY SENSITIVE OTTER BLADE
$\frac{1}{4}$" DIA. FINE SILVER CONTACTS


STANDARD SINGLE HOLE FIXING THREADED $\frac{1}{8}$" GAS. LOCATING FLATS ·315"—·320 AF
$\frac{3}{16}$" or $\frac{1}{4}$" DIA. INSULATED BRASS KNOB SPINDLE
20 AMP. CLAMP TYPE TERMINALS.


large surface area thin OTTER bimetal ensures maximum sensitivity to temperature change

Otter Type O thermostats are individually temperature set and checked to customers' requirements whilst actually carrying current and cycling under working conditions.
The temperature variation is approximately 18°F above and below a mid point setting which may be between 50°F. and 175°F. The normal setting tolerance is ± 3°F. Differential 5°F. or more. Otters work well in bad conditions of dust and dirt because they all have . . . . . .

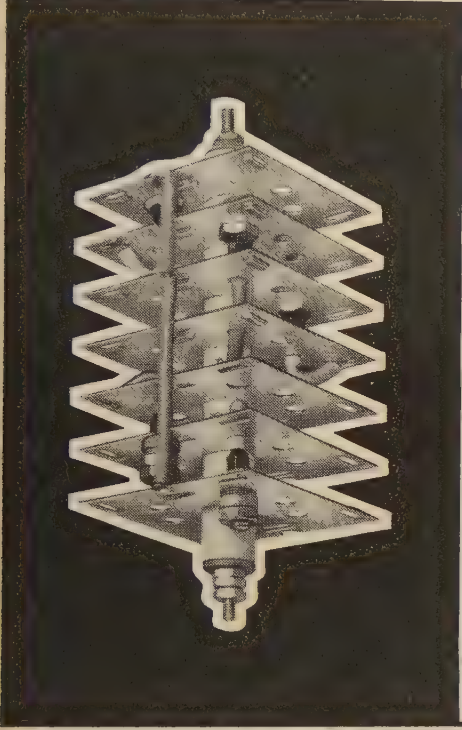
Good SNAP ACTION and HIGH CONTACT PRESSURE

OTTER CONTROLS LTD

OTTERS'OLE, BUXTON, DERBYSHIRE, PHONE BUXTON 1745 (4 lines)

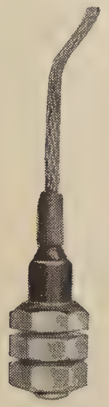
O/3

SenTerCel RS3 and RS5 silicon power diodes and rectifier stacks

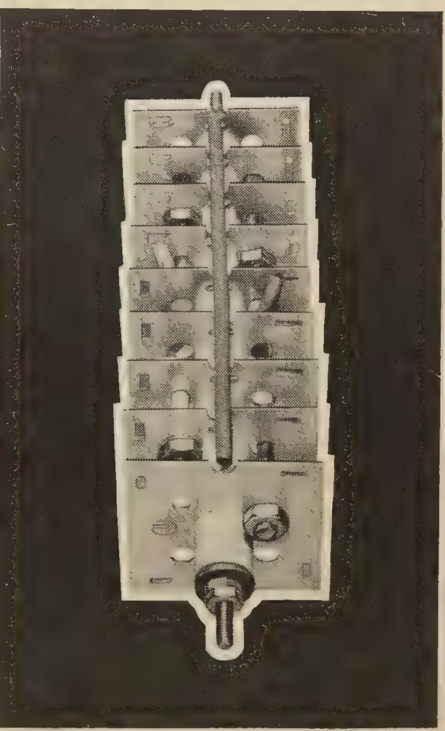


RS3 Diode
ONE AMP 50 volts to 400 volts C.W.V.

RS5 Diode
FIVE AMP 50 volts to 400 volts C.W.V.



- Available from production
- High Efficiency
- Small Size
- High Temperature Operation
- Hermetically Sealed



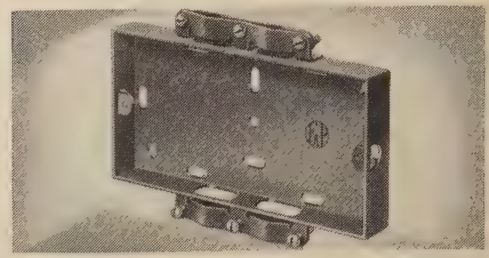
Rectifier Stacks

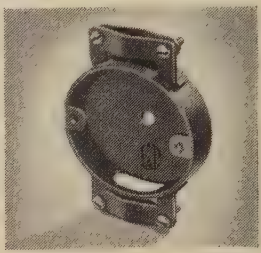
The design of SenTerCel Silicon Rectifier Stacks offers many advantages including small size, low weight and higher ambient operating temperatures (up to 100°C). At present, silicon stacks are supplied with half-wave, bridge or push-pull connections for either single-phase or three-phase inputs. The great variety of possible series and parallel connections between diodes provides an extensive range of voltage and current outputs.

Write for STC silicon rectifier technical literature:

Standard Telephones and Cables Limited
RECTIFIER DIVISION: EDINBURGH WAY · HARLOW · ESSEX

61/12MF





give me FAP fittings every time

Ask any good electrician about FAP fittings. They are good — very good. And talking of MIC boxes I have never seen better features.

NEW M.I.C. BOXES

The illustration shows the new pressed steel switch or 13 amp. socket outlet boxes designed specifically for use with M.I. cable. Sherardising gives good corrosion resistance, uniform coverage and perfect electrical conductivity.

FAP
FITTER & POULTON LTD.
THE CONDUIT FITTING SPECIALISTS

Full details in price list 105. Have you had your copy.

CONDUIT FITTINGS & ACCESSORIES — FLEXIBLE METALLIC TUBING & ADAPTORS
Telephone: CALthorpe 1151-2 Telegrams: FAP BIRMINGHAM
VINCENT PARADE - BIRMINGHAM 12

now on sale

a new edition of a popular handbook

RADIO AND ELECTRONIC LABORATORY HANDBOOK 7th Ed.

M. G. Scroggie B.Sc. M.I.E.E.

Contents

- Preface
- The end and the means
- Premises and layout
- Fundamental principles of measurement
- Sources of power and signals
- Indicators
- Standards
- Composite instruments
- Choice and care of equipment
- Measurement of circuit parameters
- Signal measurements
- Measurement of equipment characteristics
- Very high frequencies
- Dealing with results
- For reference

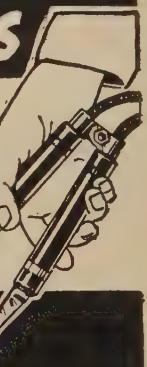
55s net by post 57s 3d

Due primarily to the growing use of semi conducting devices, including transistors, this new edition has been completely revised. It now covers techniques applicable to many fields beyond that of radio.

Electronic instruments have increased in number, cost and complexity and technicians will find invaluable guidance made easily accessible by a concise summary of all relevant information which may be required.

from leading booksellers

A "Wireless World" book published by
ILIFFE Books Ltd Dorset House Stamford Street London SE1



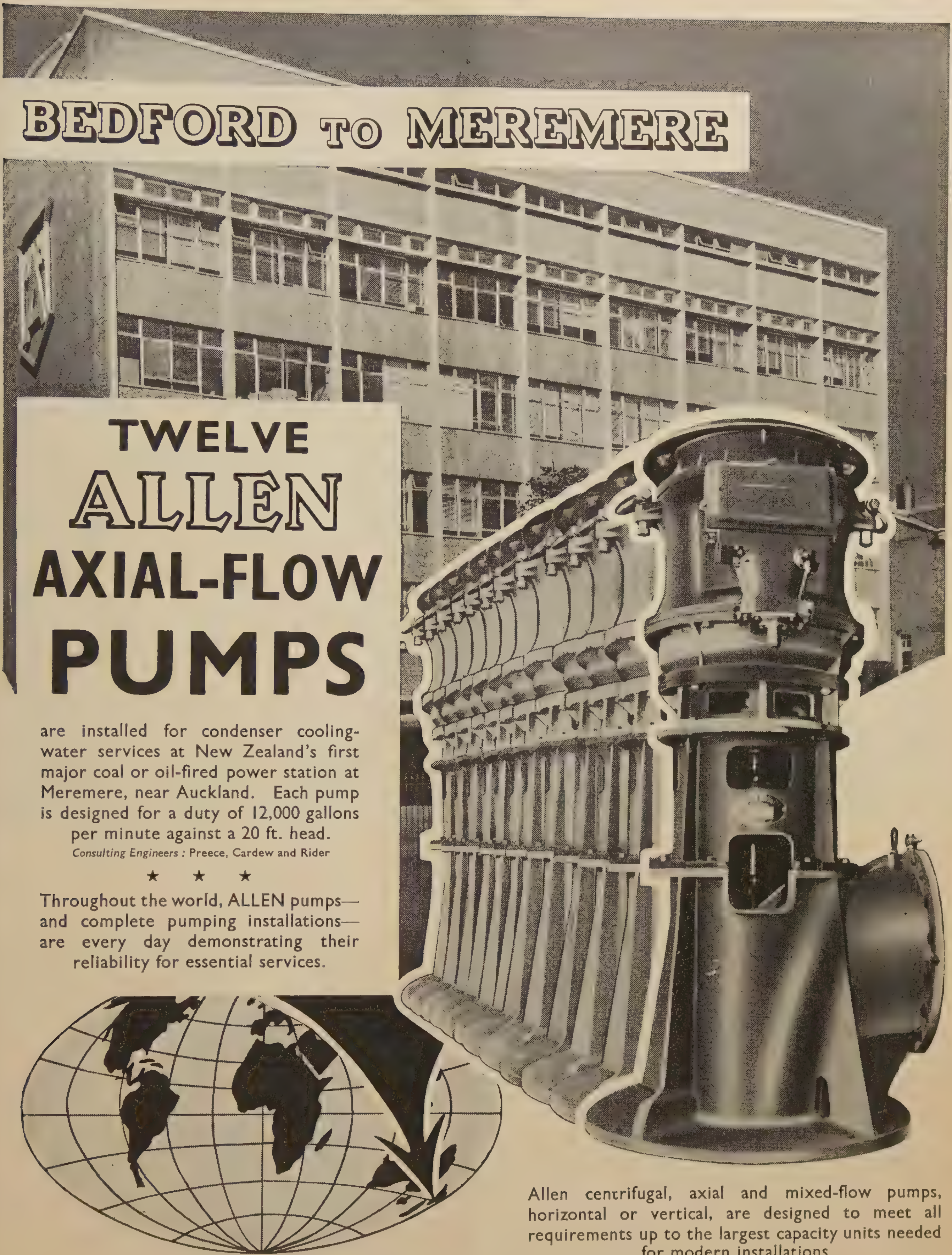
Quikheat
SOLDERING TONGS

Ideal for Garages and repair jobs. Instant soldering from cold.
Will operate from any six volt or 12 volt battery or mains transformer.
Innumerable soldering operations can be carried out in a fraction of the time and by inexperienced operators.
Send for Leaflet 25.S.

Runbaken
MANCHESTER·1

ASSEMBLY WORK
CONTROL PANELS
SPARE PARTS

KEMPSTON ELECTRICAL CO. LTD.
KEMPSTON, BEDFORD
Phone: KEMPSTON 2358



BEDFORD TO MEREMERE

TWELVE ALLEN AXIAL-FLOW PUMPS

are installed for condenser cooling-water services at New Zealand's first major coal or oil-fired power station at Meremere, near Auckland. Each pump is designed for a duty of 12,000 gallons per minute against a 20 ft. head.

Consulting Engineers : Preece, Cardew and Rider

★ ★ ★

Throughout the world, ALLEN pumps—and complete pumping installations—are every day demonstrating their reliability for essential services.

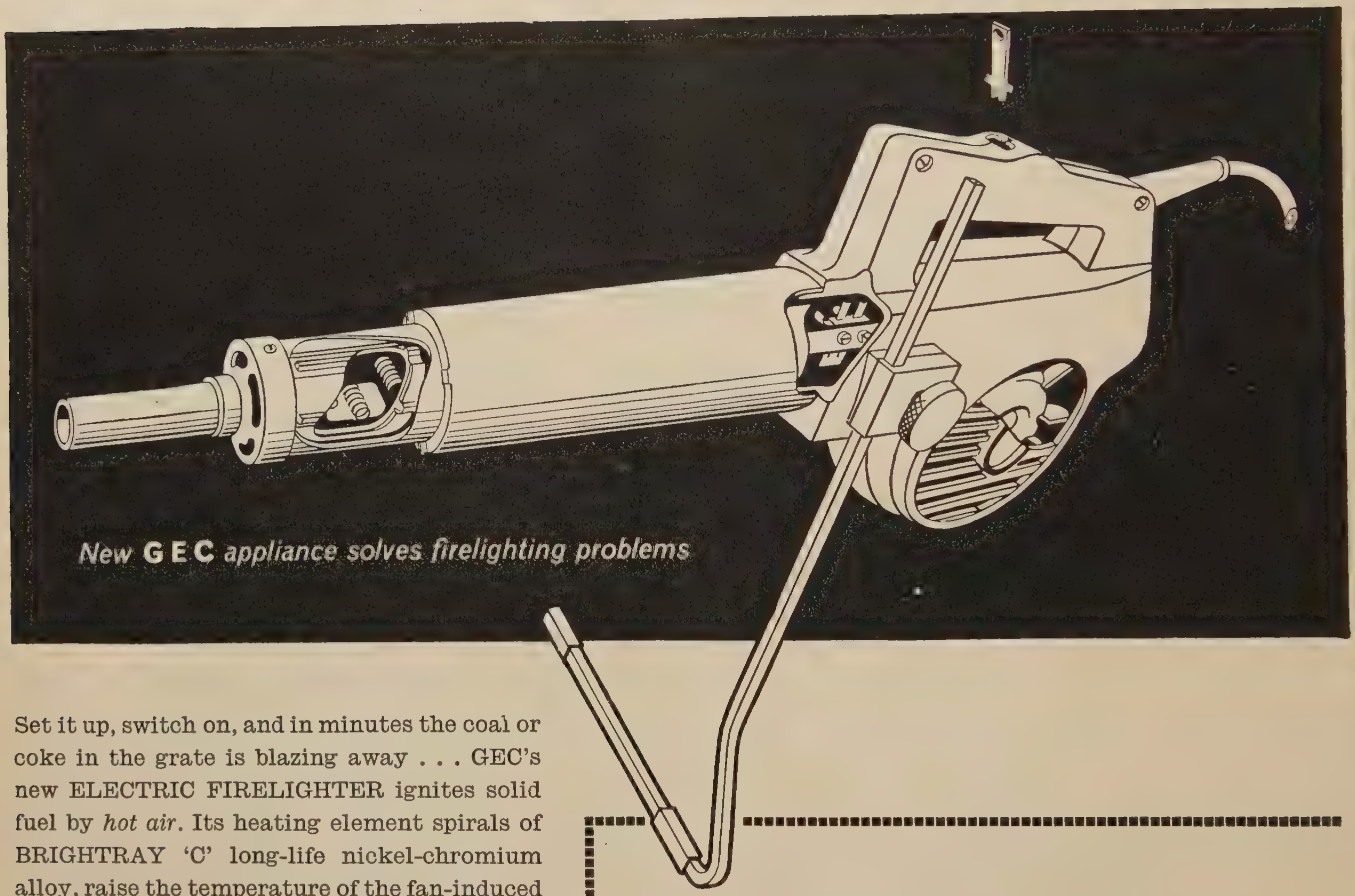
Allen centrifugal, axial and mixed-flow pumps, horizontal or vertical, are designed to meet all requirements up to the largest capacity units needed for modern installations

SPECIALISTS IN COMPLETE PUMPING PLANT INSTALLATIONS

W. H. ALLEN SONS & Cº Lᵀᴰ BEDFORD ENGLAND

Telephone : Bedford 67400. *Telegrams :* Pump Bedford Telex. (*Telex No.* 82100)

FIRELIGHTING IS FASTER WITH HEATING ELEMENT SPIRALS OF BRIGHTRAY*C ALLOY



New ***GEC*** *appliance solves firelighting problems*

Set it up, switch on, and in minutes the coal or coke in the grate is blazing away . . . GEC's new ELECTRIC FIRELIGHTER ignites solid fuel by *hot air*. Its heating element spirals of BRIGHTRAY 'C' long-life nickel-chromium alloy, raise the temperature of the fan-induced air to the point at which domestic solid fuels rapidly ignite. The 1800-watt BRIGHTRAY 'C' element can be switched off leaving the air jet to fan the flames. Running costs are low, firelighting easier, *and faster*.

Designers are invited to send for our publication giving useful data on the BRIGHTRAY Series of Electrical Resistance Materials.

*TRADE MARK

To Henry Wiggin & Company Ltd., Holmer Road, Hereford

Please send me a free copy of your publication
'Wiggin Electrical Resistance Materials'

NAME ____________________

POSITION OR DEPARTMENT ____________________

COMPANY AND ADDRESS ____________________

____

____________________ ER/E16/12

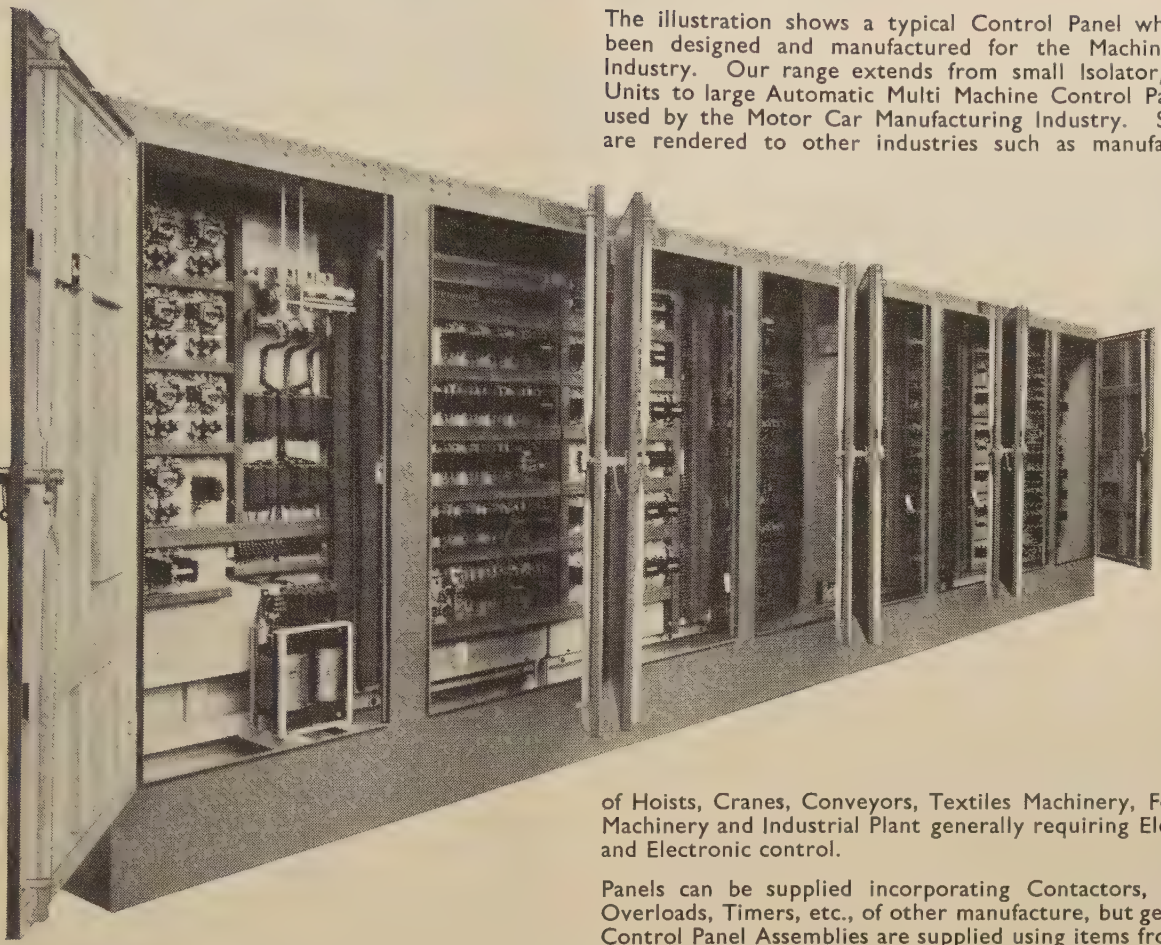
HENRY WIGGIN & COMPANY LTD · HOLMER ROAD · HEREFORD

TGA E 16

ASQUITH

ELECTRICAL CONTROL PANELS

AND ANCILLARY EQUIPMENT



A typical ASQUITH Automation Control Panel.

The illustration shows a typical Control Panel which has been designed and manufactured for the Machine Tool Industry. Our range extends from small Isolator/Starter Units to large Automatic Multi Machine Control Panels as used by the Motor Car Manufacturing Industry. Services are rendered to other industries such as manufacturers of Hoists, Cranes, Conveyors, Textiles Machinery, Foundry Machinery and Industrial Plant generally requiring Electrical and Electronic control.

Panels can be supplied incorporating Contactors, Relays, Overloads, Timers, etc., of other manufacture, but generally Control Panel Assemblies are supplied using items from our complete range of Electrical Component parts.

All Control Panels are designed, manufactured and tested strictly in accordance with B.S.S.587 - 1957 and B.S.S.2771 - 1956. Also when required to J.I.C. Standards, C.S.A. and tropical requirements (Crown Agency Approved).

Engineering and Drawing Office Services are provided for planning and detailing customers' requirements.

Manufactured by

Other products are
Special Switchgear
Control Desks
and Test Gear

ASQUITH ELECTRICS
(COLNE) LTD.
Member of the Asquith Machine Tool Corporation
Walton Street
COLNE, LANCS.

Telephone: COLNE 1394-5

LONDEX

This timer covers a wide range of industrial uses. It has a high degree of accuracy which meets all normal requirements. It is strongly made and reasonably priced. All its components are generously rated for long, trouble-free service.

The TY type timer is usually supplied in a steel case for wall mounting. There is also a steel cased form suitable for bench mounting but, if required, it can be supplied without a cover, on a steel-front panel, for flush fitting to control panels and consoles.

LONDEX ELECTRONIC TIMERS TYPE TY

TIME RANGES

TY/1	4 to 120	secs.,	calibrated	in	4	sec.	divisions
TY/2	2 to 60	secs.,	"	"	2	"	"
TY/3	1 to 30	secs.,	"	"	1	"	"
TY/4	0.5 to 15	secs.,	"	"	0.5	"	"
TY/5	0.25 to 7.5	secs.,	"	"	0.25	"	"

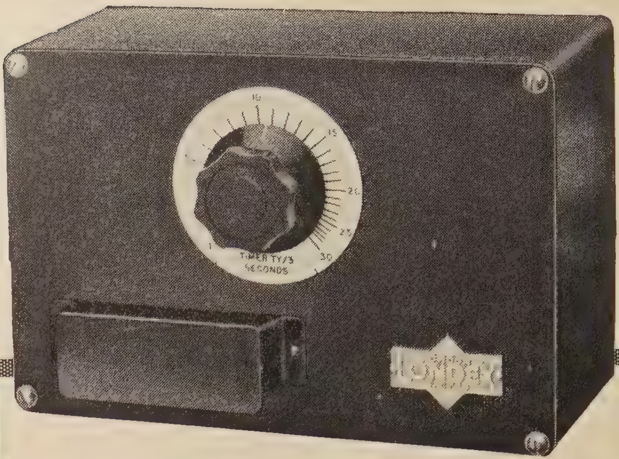
The dial is calibrated in actual time. Connections are made to a shrouded terminal block on the front panel. A multi-tapped input transformer, a Thyratron, a timing condenser and resistance are the essential components. Two Londex relays are included to give a multiplicity of switching sequences. A voltage selector covers all supplies from 200 v. to 250 v. 50 cycles in 10 v. steps and a sequence selector gives a choice of three contact sequences.

Write for List E.R./190.

Manufacturers of Electrical automatic control apparatus.

LONDEX LTD

Anerley Works, London, S.E.20. Telephone: SYDenham 3111



Zephyr **shaded pole motors**
25 w. at 2,500 r.p.m.

Precision built and specially suitable where silence is essential

Bestfrend **series motors**
25 w. at 4,500 r.p.m.

Motors suitable for Fans
Fan Heaters
Hairdryers · Valve Cooling
Projectors Etc.

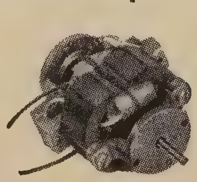
REPAIRS

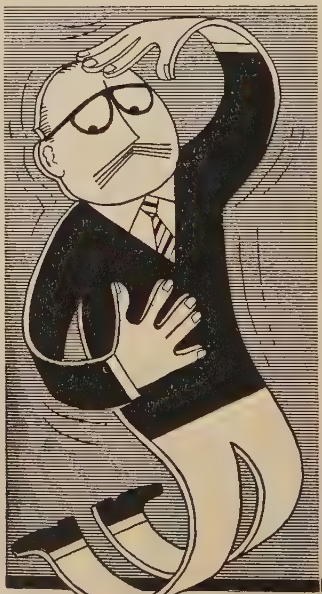
to "BESTFREND" Hairdryers undertaken. A NEW Model will shortly be available

FANS

A 4 bladed 4″ diam. fan suitable for "ZEPHYR" motors

T. A. BOXALL & CO. LTD.
20 Balcombe Road, Horley, Surrey
Telephone: Horley 4388





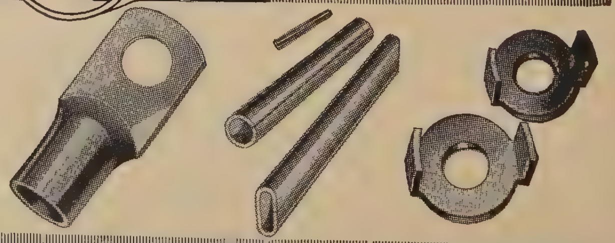
are you
HARD PRESSED
?

Everyone in Industry is hard pressed at some time but if you are hard pressed for pressings that is another matter which is easily solved—just ring us now—it's as simple as that.

We offer you 50 years of experience in the production of precision pressings, of which those illustrated are but a few examples.

THE HAMPTON WORKS (STAMPINGS) LIMITED

TWYNING ROAD
STIRCHLEY · BIRMINGHAM
Telephone: KIN 2901
Telegrams: RADIAGILLS, BIRMINGHAM



Straight to the Point . . .

Speed up your wiring

WITH VOLEX PLASTIC CABLES AND CABLE STRIPPER

Volex

SAMPLE CABLE STRIPPER

A Sample Cable Stripper (without cost) will gladly be forwarded on request to:—

VOLEX ELECTRICAL PRODUCTS LTD
(Cable Division)
SALFORD 6,

VOLEX ELECTRICAL PRODUCTS LTD.
SALFORD 6.

Telephone: PENDLETON 4373 *Telegrams:* VOLEXPROD, Salford, 6

JMC ONLAID BI-METAL

can make contact production even simpler!

Numerous forms of JMC inlaid bi-metal have been in production for many years, but now *onlaid* bi-metal is available.
With onlaid bi-metal the noble metal contact facing stands proud of the base metal backing, and already possesses final contact profile !

FINISHED CONTACTS IN JMC ONLAID BI-METAL CAN OFTEN BE PRODUCED BY A SIMPLE BLANKING OPERATION

JMC contact bi-metal consists of a base metal strip with a noble metal contact material integrally bonded in position. The use of bi-metal in large-scale contact production can offer big savings, both in noble metal and in labour costs, and many types of finished contacts can be produced by a single press operation.

Full particulars of JMC bi-metal, both onlaid and inlaid, will be sent on request. Various forms and sizes of strip are supplied as well as finished bi-metal parts to the specific designs of users.

A Specialised Product of

Johnson JMC Matthey

JOHNSON, MATTHEY & CO. LIMITED, 73-83 HATTON GARDEN, LONDON, E.C.1
Telephone : Holborn 6989
Vittoria Street, Birmingham, 1. Telephone : Central 8004
75-79 Eyre Street, Sheffield. Telephone : 29212
S12/666

Classified Advertisements

CLASSIFIED advertisements are PREPAID at 4/- per line (approx. 6 words).

DISPLAYED CLASSIFIED:—53/- per single column inch.

Where an advertisement includes a Box Number there is an additional charge of 1/-.

SERIES DISCOUNTS for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

Remittances payable to " ELECTRICAL REVIEW."

REPLIES TO BOX NUMBERS should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1. If an applicant for a situation appearing under a Box Number does not wish his reply to be forwarded to a particular firm or individual, instructions to this effect should be addressed to the Advertisement Supervisor, ELECTRICAL REVIEW. The name of an advertiser using a Box Number cannot be disclosed.

Original testimonials should not be sent with applications for employment

---

OFFICIAL NOTICES, TENDERS, ETC.

WEST LANCASHIRE RURAL DISTRICT COUNCIL

Street Lighting, A565, Water Lane/Gravel Lane, Parish of North Meols

THE Council invite tenders for the proposed supply, erection and commissioning of 55 Class A positions using 140-w. Sodium Discharge Units mounted on Concrete Columns.

Tenders may be submitted for any or all of the following three sections :—

(a) Supply of concrete columns and brackets.

(b) Supply of lanterns, discharge lamps, transformers, capacitors and time-switches.

(c) Erection of columns and brackets, fitting and wiring of electrical equipment, fuses and all requisites not supplied in (a) or (b), removal of all redundant equipment and putting the completed installation into commission.

Specification, bills of quantities and form of tender may be obtained from the Engineer and Surveyor, West Lancashire Rural District Council, Council Offices, 52, Derby Street, Ormskirk, Lancashire, on payment of a deposit of two guineas, which will be refunded on receipt of a bona fide tender not subsequently withdrawn.

Plans of the scheme may be inspected at the above Council Offices.

Sealed tenders in plain envelopes and marked " Street Lighting " must be delivered to the undersigned not later than 10 a.m. on Monday, the 8th January, 1962.

WM. RIGBY,
Clerk of the Council.
Council Offices,
52, Derby Street,
Ormskirk, Lancashire.

3238

DORSET COUNTY COUNCIL

TENDERS are invited for the supply of ELECTRIC LAMPS as the County Council may require for the School Meals Service and for other establishments maintained by the County Council for the period 1st April, 1962, to 31st March, 1964.

Forms of tender and conditions with further particulars may be obtained from the County Education Officer, County Hall, Dorchester.

Tenders must be delivered to the Clerk of the County Council by 10 a.m. on Monday, 15th January, 1962, in the special envelope provided, marked " School Canteens."

The Council do not bind themselves to accept the lowest or any tender.

3203

COUNTY BOROUGH OF BLACKPOOL

TENDERS for supply and delivery of the Corporation's Electric Lamp requirements for year ending 31st March, 1963.

Specification, form of tender, etc. (returnable 2.30 p.m. Monday, 8th January, 1962) from Director of Lighting and Electrical Services, Rigby Road East, Blackpool.

3186

WEST LOTHIAN COUNTY COUNCIL

Street Lighting of Dual Carriageway near B.M.C. Factory, Trunk Road A.8

TENDERS are invited for the supply and erection of 93 200-watt " Long " type enclosed side entry Sodium Lanterns mounted at 35 feet on Tubular Steel Columns, having an outreach of 10′ 6″ on the above Trunk Road.

Copies of the specification, bill of quantities and form of tender may be obtained from the County Electrical Manager, 212, High Street, Linlithgow, where plans may be inspected.

Tenders in sealed envelope endorsed "Tender for Street Lighting, Dual Carriageway," to be lodged with the undersigned by 10 a.m. on Saturday, 30th December.

The Council do not bind themselves to accept the lowest or any tender.

JOHN CALDER,
County Clerk.
County Buildings,
Linlithgow.
4th December, 1961.

3202

HUNTINGDONSHIRE COUNTY COUNCIL

Illumination of Roundabout, Buckden By-Pass, A.1

TENDERS are invited for the SUPPLY AND ERECTION of 12 STEEL LIGHTING COLUMNS with FITTINGS AND CONTROL GEAR at the Roundabout to be constructed at the southern end of the Buckden By-pass.

Tender documents may be obtained from the County Surveyor, Walden House, Huntingdon, on request and on forwarding a £2 deposit, which is returnable if a bona fide tender is submitted and not subsequently withdrawn.

Tenders shall be sent to the undersigned to arrive not later than noon on Wednesday, 17th January, 1962.

A. C. AYLWARD,
Clerk of the County Council.
County Buildings,
Huntingdon.

3216

CUMBERLAND COUNTY COUNCIL

Health Committee

Ambulance Service: Radio Communication Equipment

FIRMS having suitable installation and maintenance service facilities wishing to be invited to tender for the supply, fixing, connecting and setting to work of a radio communication system, operating on the 80 mc/s frequency band between one fixed station and approximately eleven vehicle-mounted transmitter/receivers, are invited to submit their names and addresses to the undersigned not later than two weeks from the appearance of this notice.

The committee reserve the right to select the list of firms to be invited to tender.

G. N. C. SWIFT,
Clerk of the County Council.
The Courts,
Carlisle.

3227

CHRISTMAS

ADVERTISEMENTS for the issue of 22nd December have now closed for press

Advertisements for 29th December are accepted up to **First Post on Thursday, 21st December**

If blocks, bold type or ruled borders are required then on **Wednesday, 20th December**

All communications to be addressed to:
Classified Advertisement Department,
ELECTRICAL REVIEW
Dorset House, Stamford Street
London, S.E.1

SITUATIONS VACANT

(See " Replies to Box Numbers " above)

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern Region

Senior Assistant Engineer, Transmission Dept.

APPLICATIONS are invited for the appointment of SENIOR ASSISTANT ENGINEER in the Transmission Department, Yorkshire Division, with headquarters at Leeds.

Applicants should have had experience in the maintenance of high-voltage switchgear, overhead lines, cables, transformers and records relating thereto. Applicants should preferably be Corporate Members of the Institution of Electrical Engineers or hold equivalent qualifications.

The salary for this appointment will be in accordance with the National Joint Board Agreement, Grade 2 or 3, Class K (£1,625-£2,085 per annum) and will commence at a point commensurate with qualifications and experience.

Forms of application may be obtained from the Regional Personnel Officer, Central Electricity Generating Board, North Eastern Region, 1, Whitehall Road, Leeds, 1, to whom they should be returned to arrive not later than 2nd January, 1962.

3219

CENTRAL ELECTRICITY GENERATING BOARD

Western Division

STATION SHIFT CHARGE ENGINEER

(ER/AV/122/61)

required at Plymouth "A" Power Station, Prince Rock, Plymouth, Devon.

Superannuation scheme. Salary N.J.B. Class F, Grade 7, Scale 8, £1,040-£1,165 per annum plus 10% shift allowance.

Applicants should possess good technical qualifications and have had training and experience in the control and operation of modern steam generating plant and main switchgear.

Good sick pay and holiday schemes are in operation.

Applications on form AE6/ACT, obtainable from the Personnel Department, 26, Oakfield Road, Bristol, 8, should be completed and returned by 29th December, 1961.

3243

Situations Vacant *(continued)*

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Region

Regional Research and Devolopment Dept., Electrical Branch

(Amended Vacancy Notices)

APPLICATIONS are invited for the following positions in the above department, located at West Farm Place, Chalk Lane, Cockfosters, Herts., unless otherwise indicated. Salaries, inclusive of London allowance, will be within the ranges described, dependent on experience, in accordance with the N.J.B. Agreement.

(a) ASSISTANT ELECTRICAL ENGINEER (Vacancy No. S.E.50/61).

The successful candidate will assist in the electrical laboratory and with field work in technical problems concerning electrical transmission plant, including overhead lines, underground cables and switching and transforming equipment. Applicants should have a sound technical training with experience in electrical power system work. A recognised electrical qualification leading to Corporate Membership of the Institution of Electrical Engineers is essential and a University Degree would be an advantage.

(b) ASSISTANT ELECTRICAL ENGINEER (Vacancy No. S.E.51/61).

The successful candidate, who will be assisting in carrying out automatic control research, will be based initially at Croydon Generating Station and will be expected to reside within a reasonable distance of his place of work. A knowledge of the operation and design of electrical plant in a generating station is necessary, and experience in instrumentation techniques and a recognised qualification leading to Corporate Membership of the Institution of Electrical Engineers would be an advantage.

Salary: Post (a) within the range of £1,205-£2,010 per annum; Post (b) within the range of £665-£1,670 per annum.

Applications, stating vacancy number, age, qualifications, experience, etc., should be sent to the Regional Secretary, Central Electricity Generating Board, South Eastern Regional Headquarters, Ergon House, Horseferry Road, London, S.W.1, to be received by 1st January, 1962.

3206

COVENTRY CORPORATION

ASSISTANT HEATING AND VENTILATING ENGINEER, Grade A.P.T. III/IV, £960-£1,310, commencing according to qualifications/experience, to be responsible for design and contract supervision of heating, ventilating, air conditioning and other building services in a varied and interesting building programme.

Associate Membership of Inst. H. & V.E. desirable.

Housing accommodation may be available. Interest-free removal expenses loan up to £50.

Application forms from City Engineer, Council House, Coventry, returnable by 1st January, 1962.

3220

REPRESENTATIVE

for LONDON and HOME COUNTIES required by firm manufacturing wiring accessories. Applicants should have technical knowledge and be well established with wholesalers, architects, consultants, contractors and authorities.

Write in full confidence to :—

E.F. ELECTRIC LTD.
WILLOW LANE, WATFORD, HERTS.

3212

BRITISH OVERSEAS AIRWAYS CORPORATION

invite applications from

QUALIFIED ELECTRICAL ENGINEERS

for a position in their Properties and Services Branch at London Airport.

An appointment is immediately available for an Assistant Engineer who wishes to work with a progressive and expanding organisation on a variety of interesting work.

SALARY RANGE £1,176.0.0d. to £1,417.10.0d.

The successful applicant will be responsible for all works associated with the installation of and alterations to industrial power and lighting schemes.

Applications, giving brief details, should be sent to :—

Selection Services Manager
B.O.A.C.
London Airport, Hounslow, Middlesex

3194

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

No. 2 Sub-Area

THIRD ASSISTANT COMMERCIAL ENGINEER required at the Board's No. 2 Sub-Area Headquarters, Sandiway House, Northwich, Cheshire. Salary within range £1,190/£1,325 per annum (N.J.B. L/10, Scale 10).

Applicants must have completed a recognised electrical engineering apprenticeship and should possess an appropriate technical qualification. Experience in the operation of a contracting department and negotiations with consumers would be an advantage.

Duties will include general assistance with the technical and administrative work of the Sub-Area Commercial Officer's Department, with particular reference to development in the utilisation of supply by commercial, agricultural and industrial consumers.

Appointment subject to medical examination. Pension scheme.

Application forms obtainable from the Manager, No. 2 Sub-Area, at the above address. Closing date 29th December, 1961.

3241

LONDON ELECTRICITY BOARD

Assistant Distribution Engineer

APPLICATIONS are invited for the above position in the Board's South Eastern District at 44, Powis Street, Woolwich, London, S.E.18.

Applicants should have a sound technical education to the standard of the Higher National Certificate and possess practical experience of all branches of engineering work associated with the organisation of a District distribution department.

The post is graded under Schedule A of the National Joint Board Agreement as Class H, Grade 9, i.e., £1,090 per annum, rising to £1,215 per annum, inclusive of London allowance.

Applications should be sent to the Manager at the above address within fourteen days of the publication date of this notice. Please quote ref. PER/V/3483/R.

3196

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Region

East Midlands Division

ASSISTANT ENGINEER (Control Room), LEICESTER POWER STATION (Vacancy No. 252/61).

Applications are invited for the position of Assistant Engineer (Control Room) at Leicester Power Station, Rawdykes Road, Leicester.

Candidates for this post should be suitably qualified and preferably have had power plant experience.

Salary will be in accordance with Class G, Grade 13 (£715-£805 per annum) of the National Joint Board Agreement, plus £90 per annum allowance whilst engaged on shift duties, and the position will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Closing date for receipt of applications, 22nd December, 1961.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Station Superintendent and should be returned to him by the date stated.

O. S. WOODS,
Assistant Regional Director.

3230

BRITISH JEFFREY-DIAMOND LTD.

require the services of a

QUALIFIED MOTOR DESIGNER

to undertake electrical and mechanical design of A.C. machines for the mining industry in this country and abroad. Special-purpose machines in a quickly advancing field of application are involved and the position offers wide scope in a well-established and expanding concern.

Write to the Secretary at Stennard Works, Wakefield, giving details of experience and technical qualifications, and quoting ref. ENG. 2.

3123

SOUTH EASTERN ELECTRICITY BOARD

SENIOR ASSISTANT ENGINEER
(Planning and Development)
at Sub-Area H.Q., Kent.

Salary £1,795-£1,950 per annum in accordance with N.J.B. Class L, Grade 4. Superannuable. Consideration will be given to a car allowance and to assistance with house purchase in appropriate circumstances. The appointed person will take charge of the planning and development section and will be responsible to the Sub-Area Engineer for the preparation of short and long-term plans for the development of major transmission and distribution throughout the Sub-Area, together with the co-ordination of District H.V. and M.V. planning proposals. Corporate Membership of the I.E.E. is desirable and candidates should have extensive responsible practical experience of distribution works up to 33 kV, in addition to technical planning experience. Kent Sub-Area, covering some 1,000 square miles, supplies 324,000 consumers and has a maximum demand of 412 MW. Supplies are afforded to substantial and miscellaneous industries, to urban and rural territories, and for summer seasonal purposes in the coastal resorts.

Applications, quoting ER, to Kent Area Manager, 178, High Street, Rochester, Kent, by 29th December, 1961.

ASSISTANT DISTRICT ENGINEER,
Thanet District.

Salary £1,040 - £1,165 per annum under N.J.B. Class F, Grade 7. Superannuable. This appointment occurs in a rapidly expanding district comprising seaside resorts and rural area. Applicants should be of good education, have technical training to Higher National Certificate standard, with practical experience of general distribution work, and be capable of assisting on planning, construction and maintenance work. Duties will include standby. Consideration will be given to a private car allowance and a service tenancy of a Board flat will be granted if desired.

Applications, quoting ER, and naming two referees, to District Manager, SEEBOARD, Electricity Offices, St. Peter's, Broadstairs, Kent, by 29th December, 1961.

GEORGE WRAY,
Secretary.

3244

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Region, North Thames Division

APPLICATIONS are invited for the following appointment :—

GENERAL ASSISTANT ENGINEER,
BRADWELL (Nuclear)
GENERATING STATION (Essex)
(S.V. No. 1513).

Salary N.J.B. Class M, within the range of Grades 20-17, Scales 1-4, £625-£870 per annum plus £90 per annum shift allowance when required to work on shift. The commencing salary will depend upon the duties and responsibilities.

The duties associated with this post will include assisting in the operation of nuclear reactors and conventional turbo-alternating plant. Plant testing and maintenance work.

Previous experience in a generating station and technical training to the standard of the Ordinary or Higher National Certificate or the equivalent will be an advantage.

Applications, quoting reference S.V. No. 1513, stating age, qualifications, experience and present position should be sent to the Assistant Regional Personnel Officer, Central Electricity Generating Board, South Eastern Region, North Thames Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts., to arrive not later than 23rd December, 1961.

F. W. SKELCHER,
Assistant Regional Director.

3205

CENTRAL ELECTRICITY GENERATING BOARD

South Western Region

Regional Electrical Department

Contract Engineers

APPLICATIONS are invited from Electrical Engineers for posts in the Contracts Section of the Regional Electrical Department, situated at Bradford House, St. Stephen's Avenue, Bristol, 1.

The contract engineering required involves the preparation of technical enquiries and tender assessment for 132-kV and lower-voltage transmission plant, including switchgear, transformers, overhead lines and cables, control and protection equipment. Experience in one or more of these branches is essential.

Applicants should possess an H.N.C. in Electrical engineering and preferably supplementary qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

The salary will be within the scale £1,235 to £1,500 per annum.

Applications on form A.E.6/ACT, obtainable from the Regional Personnel Officer, Oakfield House, Oakfield Grove, Clifton, Bristol 8, should be returned by the 28th December, 1961.

3236

CENTRAL ELECTRICITY GENERATING BOARD

South Western Region

Regional Electrical Department

Third Assistant Civil Engineers
(Site Construction Transmission)

VACANCIES exist for three THIRD ASSISTANT CIVIL ENGINEERS (Site Construction Transmission) in the Transmission Project Group of the Regional Electrical Department to be situated at Neath, Reading and Cardiff.

Candidates should have had a good general and higher technical education in the field of building and civil engineering.

The duties are concerned with the supervision of civil engineering and building work required in connection with the establishment or extension of high-voltage substations.

The salary for these posts will be within the scale £1,145 to £1,410 per annum.

Applications on forms A.E.6/ACT, obtainable from the Regional Personnel Officer, Oakfield House, Oakfield Grove, Clifton, Bristol, 8, should be returned by the 30th December, 1961, indicating for which post application is being made.

3233

J. & P.

ASSISTANT TO CHIEF DRAUGHTSMAN

JOHNSON & PHILLIPS Ltd. invite applications for the position of Assistant to Chief Draughtsman in their Switchgear Department, at their works in London. This is a responsible position in an expanding department whose activities are world-wide.

Candidates must have practical and D.O. experience in L.V. and H.V. industrial switchgear.

Applications, which will be treated in confidence, stating age, training and experience, should be addressed to the Employment Manager, Johnson & Phillips Ltd., Charlton, London, S.E.7.

3187

CENTRAL ELECTRICITY GENERATING BOARD

West Midlands Division

STATION SHIFT CONTROL ENGINEERS are required at Drakelow "A" Power Station, Derbyshire. N.J.B. service conditions, superannuable appointment, salary within Schedule A of the Agreement, Grade J.10, £1,040-£1,165 per annum, plus £50 plus 10% shift allowance.

A sound technical training and practical experience in the control of steam generating plant and main switchgear are required. Appropriate technical qualifications an advantage.

Apply, quoting Vacancy No. 301/61 MR, on form AE6, available from the Station Superintendent, Drakelow Power Station, near Burton-on-Trent, to be completed and returned by the 27th December, 1961.

3228

BRITISH ENGINE BOILER & ELECTRICAL INSURANCE CO. LTD.

Longridge House, Manchester, 4

ELECTRICAL SURVEYORS required. Permanent positions carrying progressive salary scale £825 to £1,225 with non-contributory pension. Candidates, aged 26 to 32, with H.N.C. in Electrical Engineering or Grad. I.E.E., and with apprenticeship in manufacture or repair of electrical machinery, are invited to apply stating age, qualifications and experience.

3193

Eastern Electricity

Northmet Sub-Area

ST. ALBANS DISTRICT

THIRD ASSISTANT ENGINEER
(Ref. 1052) (257/61.R).

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. distribution systems, including substations.

Salary N.J.B. Class H, Grade 9 (£1,040-£1,165).

Apply by letter to F. J. Drake, Assoc.I.E.E., Manager, Eastern Electricity, 107, St. Peter's Street, St. Albans, Herts., by 29th December, 1961.

GENERAL ASSISTANT ENGINEER,
DEVELOPMENT SECTION
(Ref. 1100) (258/61.R).

Candidates should have had a good general and technical education and possess the Higher National Certificate or equivalent qualifications. Previous experience in planning and development work will be an advantage.

Salary N.J.B. Class N, Grade 18/14, within range of £815 - £1,090 inclusive of London allowance, the grade to be dependent upon qualifications and experience.

Apply by letter to the Manager, Eastern Electricity, Northmet Sub-Area, Northmet House, Southgate, London, N.14, by 29th December, 1961.

3226

Situations Vacant (continued)

MIDLANDS ELECTRICITY BOARD

SENIOR ASSISTANT (First Assistant to District Senior Clerk) required at Severn Vale District. In addition to general assistance to the District Senior Clerk, this post is one of Section Leader in charge of the Income Section which includes responsibility for consumers' records and meter reading. A knowledge of stores, wages, costing and billing would be an advantage. Applicants must be able to control staff.

Salary £890/£1,010 per annum (N.J.C. Grade 4). Superannuable.

Apply by letter within 10 days, stating age, qualifications and present position, to Mr. S. Raybould, Area Manager, Midlands Electricity Board, Eastern Avenue, Gloucester.

F. W. CATER,
Secretary.

3237

CENTRAL ELECTRICITY GENERATING BOARD

West Midlands Division

THIRD ASSISTANT ENGINEER is required in the Bushbury (Wolverhampton) Transmission District. N.J.B. Agreement conditions, superannuable appointment, salary within Schedule A, Class L, Grade 8, Scale 12, commencing at a figure commensurate with qualifications and experience. The salary range is £1,165-£1,500 per annum.

Candidates should preferably possess a Higher National Certificate in Electrical Engineering or equivalent qualifications, and should have had experience in all types of protective gear as well as the testing and commissioning of new plant. The successful candidate will have an opportunity for interchange of duties associated with E.H.V. transmission plant.

Apply, quoting Vacancy No. 300/61 MR, on application form AE6, available from the District Engineer, Bushbury District Office, Central Electricity Generating Board, off Greenfield Lane, Fordhouses, Wolverhampton, to be completed and returned by not later than 27th December, 1961.

3229

TO ALL ELECTRICAL DESIGN ENGINEERS AND DRAUGHTSMEN

WE are shortly moving into a new modern office building and have vacancies for DESIGN ENGINEERS and DRAUGHTSMEN who are interested in installation design in all classes of industrial and commercial buildings, including

AIRPORTS	NEW HOSPITALS
HOTELS	OFFICE BLOCKS
UNIVERSITIES	SCHOOLS

both at home and abroad.

Spring and summer holidays, pension scheme and luncheon vouchers.

Apply in writing stating age, experience, qualifications, present salary and salary required to :—

J. ROGER PRESTON & PARTNERS
15, North Audley Street
London, W.1

3164

SOUTH OF SCOTLAND ELECTRICITY BOARD

APPLICATIONS are invited for a superannuable appointment as a FOURTH ASSISTANT ENGINEER (Heating and Ventilating) on the staff of the Chief Commercial Engineer.

Candidates should have had a sound technical training with qualifications preferably leading to membership of the Institution of Electrical Engineers and/or the Institution of Heating and Ventilating Engineers. Some experience in the preparation of estimates, specifications and drawings for central heating installations is desirable. Duties will include the design of electrical space heating schemes including floor warming, electrode boilers, block storage heaters and other heating systems.

Salary N.J.B. Class K, Grade 9, £1,050/£1,325 per annum.

Applications, quoting reference C.29/61, should be submitted on the standard form to the Secretary, South of Scotland Electricity Board, Inverlair Avenue, Glasgow, S.4, not later than Friday, 29th December, 1961.

3224

General Assistant Engineer

Sub-Area Engineering Department (Meter Section) of No. 1 (Southall) Sub-Area, located at Waterloo Road, Uxbridge, Middlesex. Salary N.J.B. Class M, Grade 16 (£875 - £990 per annum, inclusive of London allowance).

Applicants should have experience in three-phase meter testing, instrument transformer testing, assisting in the standardising of wattmeters and the commissioning of special equipment.

The successful candidate will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, Southern Electricity Board, 2/6, Windmill Lane, Southall, Middlesex, and returned to him, quoting Z.1451, not later than 27th December, 1961.

3242

J. & P. require

PLANT SALES ENGINEERS

A major reorganisation of their selling structure which Johnson & Phillips Ltd. are about to make, will create vacancies at their Glasgow, Edinburgh, Bradford, Sheffield and Birmingham branches for Sales Engineers to handle the sale of switchgear, transformers and capacitors.

These are permanent and responsible appointments with scope for advancement, and for which cars are provided.

Applications are invited from chartered electrical engineers or from men with H.N.C. in electrical engineering. Qualified men without sales experience will be considered for training, but a knowledge of switchgear is desirable. Initial interviews will be arranged locally.

Applications giving details of experience and training should be addressed to Mr. R. L. Stanley, Sales Manager (Plant), Johnson & Phillips Ltd., Columbia House, Aldwych, London, W.C.2.

3247

NORTH WESTERN ELECTRICITY BOARD

Third Assistant District Engineer, Central District, Manchester

THE duties will include assisting in the supervision of erection and maintenance of substation switchgear, laying and jointing of cables, keeping of substation records, etc. Applicants should preferably hold H.N.C. in Electrical Engineering and should have had practical experience in substation work, operation, cable laying and jointing, etc. Corporate Membership of the Institution of Electrical Engineers will be an advantage.

Salary scale £1,115/£1,245 p.a., Grade J.9. N.J.B. conditions.

Applications on forms to be obtained from the Manager (Staff Vacancy), No. 1 Sub-Area, North Western Electricity Board, Town Hall, Manchester, 2, P.O. Box 493, and returned to him by 28th December, 1961.

3207

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Northern Area

Demonstrator

APPLICATIONS are invited for the above post in the Northern Area and Caithness. Candidates should be qualified in domestic science and have some knowledge of sales methods and experience in giving public demonstrations.

Salary £600 - £700 (N.J.C.I.) with placing according to qualifications and experience. Superannuation scheme.

Applications in own handwriting to be submitted to the Area Manager, High Street, Dingwall, not later than 22nd December, 1961.

3209

MEDWAY WATER BOARD

ENGINEERING ASSISTANT (Electrical) required for duty in the Supply Department. H.N.C. in Electrical Engineering necessary. Duties include design of layouts for pumping plant, electrical installations and supervision of maintenance.

Salary £645 to £960 (A.P.T. I-II), starting point according to experience. Local government conditions of service and superannuation scheme apply.

Write Engineer and Manager, 25, Railway Street, Chatham, giving age and experience.

3197

BRITMAC ELECTRICAL COMPANY LTD.

Manufacturers of
High-Class Electrical Accessories

require a

REPRESENTATIVE

for the Counties of CUMBERLAND, WESTMORLAND, LANCASHIRE, CHESHIRE and NORTH WALES.

Candidates must have good connections with consulting engineers, local authorities, electrical contractors and wholesalers.

Remuneration by salary, commission and expenses. Company car provided. Contributory pension scheme.

Reply giving details of age and full particulars of experience, also salary required, to Britmac Electrical Co. Ltd., Britannia Works, Wharfdale Rd., Tyseley, Birmingham, 11.

3217

YORKSHIRE ELECTRICITY BOARD

No. 6 (Hull) Sub-Area

HULL DISTRICT

THIRD ASSISTANT DISTRICT ENGINEER.

Candidates should have had responsible experience in planning, construction, operation and maintenance of underground and overhead systems.

The successful applicant will be required to work initially in the Beverley Unit of the Hull District and to undertake standby duty.

Salary N.J.B. Class K, Grade 9 (Scale 10), £1,190/£1,325 per annum.

Applications, together with the names of two referees, should be sent to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Hull, not later than 1st January, 1962.

No. 7 (Grimsby) Sub-Area

GRIMSBY DISTRICT

SECOND ASSISTANT DISTRICT ENGINEER.

Applicants should have had a sound training and extensive experience in the design, construction, operation and maintenance of H.V. and L.V. underground and overhead distribution systems, substation plant and ancillary equipment in both urban and rural areas.

Salary N.J.B. Class H, Grade 7 (Scale 10), £1,190/£1,325 per annum.

Applications, together with the names of two referees, should be sent to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Road, Grimsby, not later than 1st January, 1962.

No. 1 (Bradford) Sub-Area

HOUSECRAFT ADVISER (Female).

Applicants should be qualified Demonstrators holding recognised diplomas in domestic science and possess the E.A.W. Certificate. They must have had considerable experience in the organisation of a demonstration and lecture service, control of staff, and be capable of establishing relations with education authorities, institutions, industrial and commercial catering establishments, and advising them on the use of electrical equipment.

Salary N.J.C. Grade 4, £890/£30/£1,010 per annum.

Applications, together with the names of two referees, should be sent to the Manager, No. 1 (Bradford) Sub-Area, Yorkshire Electricity Board, 45/53, Sunbridge Rd., Bradford, 1, not later than 1st January, 1962.

No. 3 (Sheffield) Sub-Area

GENERAL ASSISTANT ENGINEER (Civil Draughtsman). Two posts.

Applicants should have had experience in the preparation of simple building drawings.

Salary N.J.B. either Class N, Grade 19 (Scale 3), £715/£805 per annum, or Class N, Grade 18 (Scale 4), £765/£870 per annum, according to experience and qualifications.

Applications, together with the names of two referees, should be sent to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Change Alley, Sheffield, 1, not later than 1st January, 1962.

3245

DRAUGHTSMEN

SEVERAL Draughtsmen are required for the mechanical developments of electric motors, A.C. and D.C., shafts, frames, end brackets, etc. Experience of flameproof motor design an advantage.

Good wages; pension scheme; 5-day week.

Box 3218

CANADA

PROMINENT Montreal company seeks DESIGN ENGINEERS with Degree or Corporate Membership of the Institution of Mechanical Engineers required for work on large capacity thermal generating stations.

Applicants must have had a minimum of five years' experience, from date of acceptance to Corporate Membership in the Institution, in the design and layout of thermal plant equipment. This experience should include specification writing, pipework layout and design, cost estimating and evaluation of thermodynamic problems.

Salary range $570 to $650 per month.

Apply to :—

Dept. M.E.C.
NATIONAL EMPLOYMENT SERVICE OF CANADA
38, Grosvenor Street, London, W.1

3188

CENTRAL ELECTRICITY GENERATING BOARD

South Western Region

Regional Electrical Department

Third Assistant Engineer (Electrical), Drawing Office

Fourth Assistant Engineer (Electrical), Drawing Office

APPLICATIONS are invited for the following positions :—

(a) THIRD ASSISTANT ENGINEER (Electrical), Drawing Office
(b) FOURTH ASSISTANT ENGINEER (Electrical), Drawing Office

in the Regional Electrical Department situated at Bradford House, St. Stephen's Avenue, Bristol, 1.

The work will be associated with high-voltage transforming and switching stations and will comprise the preparation for :—

Switchgear electrical layouts.
Overhead line profiles.
Cable routes.
Schematic and wiring diagrams for protection and communications equipment.

Applicants should be competent draughtsmen and have had a good general and technical education.

The salary for post (a) will be within the scale £1,145 to £1,410 per annum, and for post (b) within the scale £900 to £1,245 per annum, the point of entry in each case depending on ability, age and previous experience.

Applications on forms A.E.6/ACT, obtainable from the Regional Personnel Officer, Oakfield House, Oakfield Grove, Clifton, Bristol, 8, should be returned by the 29th December, 1961, indicating for which post application is being made.

3232

HUNTINGDONSHIRE COUNTY ARCHITECT'S DEPARTMENT

Technical Assistant (Electrical Engineer)

APPLICATIONS are invited for the above appointment on Grade A.P.T. III (£960-£1,140) or Grade A.P.T. IV (£1,140-£1,310) according to qualifications.

The person appointed will be a member of the Engineering Section of the Department, and his duties will consist of all works connected with electrical installations related to both small and large building projects.

Application forms may be obtained from the Deputy County Architect, County Buildings, Huntingdon, and completed forms should be returned to the undersigned by Saturday, 6th January, 1962.

A. C. AYLWARD,
Clerk of the County Council.

County Buildings,
Huntingdon.

3225

CENTRAL ELECTRICITY GENERATING BOARD

South Western Region

Regional Electrical Department

Third Assistant Engineer in the Programmes and Progress Section

A VACANCY exists for a THIRD ASSISTANT ENGINEER in the Programmes and Progress Section of the Regional Electrical Department, situated at Bradford House, St. Stephen's Avenue, Bristol, 1.

The work involved will be the programming and progressing of Regional transmission projects from their inception to completion, i.e., from the preparation of system design reports to commissioning on site. Co-ordination of detailed programmes in conjunction with site construction and system operation staff is an essential feature of this post.

Site construction experience on the Board's transmission system would be an advantage. Preference will be given to candidates who possess, or are completing, qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

The salary will be within the scale £1,235 to £1,500 per annum.

Applications on forms A.E.6/ACT, obtainable from the Regional Personnel Officer, Oakfield House, Oakfield Grove, Clifton, Bristol 8, should be returned by the 28th December, 1961.

3235

CENTRAL ELECTRICITY GENERATING BOARD

West Midlands Division

STATION SHIFT CONTROL ENGINEER is required at Coventry Power Station, Warwickshire. N.J.B. service conditions, superannuable appointment, salary within Schedule A of the Agreement, Grade G.10, £890 to £1,015 per annum, plus 10% shift allowance (minimum £90).

A sound technical training and practical experience in the control of steam generating plant and main switchgear are required. Appropriate technical qualifications an advantage.

Apply, quoting Vacancy No. 294/61 MR, on form AE6, available from the Station Superintendent, Coventry Power Station, Alderman's Green, Coventry, Warks., by 27th December, 1961.

3231

OVERHEAD TRANSMISSION LINE ENGINEERS

AGENTS, SUB-AGENTS and ASSISTANT ENGINEERS required by major firm of contractors for 275 and 132-kV steel tower and wood pole lines in Scotland.

Applications, which will be treated in confidence, giving full particulars of experience to — Box No. 761, Keith & Co., 11, Castle Street, Edinburgh.

3211

Situations Vacant (continued)

CONSTRUCTORS JOHN BROWN LIMITED

have vacancies for

SUPERVISING ELECTRICAL ENGINEERS

APPLICANTS should have served a full apprenticeship with a reputable electrical contractor, possess a recognised technical qualification, and have experience of large industrial and flameproof installations from estimating to final account stage.

The successful candidates will be required to reside on sites in the U.K. and abroad for periods of from one to two years. Good salaries and allowances. Contributory pension scheme with life assurance benefits.

Please apply in writing, giving details of age, experience and qualifications, to:

Personnel Manager
CONSTRUCTORS JOHN BROWN LIMITED
CJB House, Eastbourne Terrace
Paddington, London, W.2
quoting reference No. N9504 [334

SOUTH WESTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following position :—

DISTRICT COMMERCIAL MANAGER, BRISTOL EAST.

Bristol is divided, for commercial purposes, into four Districts, each of which has a Commercial Manager graded within the N.J.M.C. Agreement, and applications are now invited for the post of District Commercial Manager, Bristol East.

The salary scale for this post is £1,965 to £2,170 per annum within Class C, Grade 4 of the N.J.M.C. Agreement.

The person appointed will be responsible to the District Manager, Bristol, for the efficient administration of the Commercial District and for the maintenance of a high standard of consumer service.

The duties will include the promotion and development of all activities relating to sales, contracting and consumer services for the 52,000 consumers in the District; this will entail the organisation and control of an establishment at present comprising approximately 175 employees and containing three service centres.

Candidates should possess drive and initiative, coupled with an extensive knowledge of and wide experience on the commercial side of the industry. They must be capable of promoting a progressive commercial development policy.

Detailed applications stating age, present post and salary, qualifications and experience should reach the Personnel Officer, South Western Electricity Board, Electricity House, Colston Avenue, Bristol, 1, by 30th December, 1961.
3246

NORTH WESTERN ELECTRICITY BOARD

General Assistant Engineer (Draughtsman, Sub-Area Engineering Department, Oldham

APPLICANTS should be experienced in substation design, system diagrams and general drawing office duties.

Salary scale £765/£870 p.a., Grade L.16. N.J.B. conditions.

Applications on forms to be obtained from the Manager, No. 3 Sub-Area, North Western Electricity Board, Union Street, Oldham, and returned to him by 23rd December, 1961.
3240

CENTRAL ELECTRICITY GENERATING BOARD

South Western Region

Regional Electrical Department

Third Assistant Civil Engineer, Transmission Project Group

APPLICATIONS are invited for the post of THIRD ASSISTANT CIVIL ENGINEER in the Civil Engineering Section of the Regional Electrical Department situated at Bradford House, St. Stephen's Avenue, Bristol 1.

Candidates should preferably be corporate members of one of the recognised engineering institutions and have a wide experience of civil engineering work.

The duties are concerned with all aspects of the design and construction by contract of the civil engineering and building work required in connection with the establishment or extension of high-voltage substations.

The salary will be within the scale £1,235 to £1,500 per annum.

Applications on form A.E.6/ACT, obtainable from the Regional Personnel Officer, Oakfield House, Oakfield Grove, Clifton, Bristol 8, should be returned by 30th December, 1961.
3234

PATENT EXAMINERS AND PATENT OFFICERS

PENSIONABLE posts for men or women normally under 36 on 31st December of the year in which they apply, for work on the examination of Patent applications. Qualifications: normally a degree, or Dip. Tech., with 1st or 2nd class honours in physics, chemistry, engineering or mathematics, or equivalent attainment, or professional qualification, e.g., A.M.I.C.E., A.M.I.Mech.E., A.M.I.E.E., A.M. Inst.Chem.Eng., A.R.I.C., A.Inst.P.

Inner London salary £793-£1,719; starting salary may be above minimum. Promotion prospects.

Write Civil Service Commission, 17, North Audley Street, London, W.1, for application form, quoting **S/128.**
3210

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

South Caledonia Area

APPLICATIONS are invited for the post of ENGINEERING DRAUGHTSMAN based at Perth. N.J.B. Agreement and conditions. Common Salary Scale 4 (£765/£870).

Applicants should have had a good general and technical education, and experience in the preparation of primary substation layouts, engineering drawings and electrical schematic diagrams. Experience of civil works would be desirable.

Applications within a fortnight of the appearance of this advertisement on forms obtainable from the Area Manager, Blackfriars, Perth.
3208

LONDON COUNTY COUNCIL

Northern Outfall Works, Beckton, London, E.6

ASSISTANT SUPERINTENDENT (Electrical) required to be responsible under Supervising Engineer and Works Superintendent for operation and maintenance of the electrical installation and plant, including 3.3-kV alternators, H.V. and L.V. switchgear, transformers, motors, etc., totalling 2½ megawatts, also supervision of electrical maintenance staff. Recognised electrical qualifications an advantage.

Salary rising to £1,400. Permanent and pensionable.

Form from Chief Engineer (GS/R/3294/12), County Hall, London, S.E.1.
3248

NORTH EASTERN ELECTRICITY BOARD

Harrogate Sub-Area

APPLICATIONS are invited from suitably qualified engineers for the appointment of SECOND ASSISTANT DISTRICT ENGINEER, Northallerton District, with location at Richmond. Applicants should have had experience in the construction, operation and maintenance of H.V. and L.V. systems. A house is available for letting to the successful candidate.

Salary Schedule A, Class E, Grade 7, £965/£1,090 per annum. N.J.B. conditions of service.

Applications in writing, stating age, qualifications and experience, to be received by Assistant Secretary (Establishments), North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, 1, within ten days of the appearance of this advertisement.
3239

TECHNICAL SALES REPRESENTATIVE

required by old-established company in electric light fittings. Diploma Members of the Illuminating Engineering Society preferred. Vacancies exist in the following areas :—

LANCASHIRE and NORTH-WEST.
YORKSHIRE and NORTH-EAST.
MIDLANDS.
SOUTH WALES.
SCOTLAND.

Excellent opportunities for selected personnel in rapidly expanding organisation.

Applications will be treated in strictest confidence. Please reply to—Box 3250.

THE BANK OF ENGLAND

MECHANICAL ENGINEER, preferably under 40 years of age, required to supervise the operation and maintenance of diesel generating plant, oil-fired boilers, pumps and ventilation apparatus. Salary within the range of £1,250-£1,600 according to age, qualifications and experience. Non-contributory pension.

Applications giving full personal and career details to Chief Engineer, Bank of England, London, E.C.2. 3195

OPPORTUNITIES FOR CABLE ENGINEERS (ELECTRICAL)

VACANCIES exist at an expanding electric cable factory in the London area.

Applicants are required for posts in the development and engineering depts. Knowledge of cable design an advantage. Minimum qualifications H.N.C. Salary commensurate with ability. Attractive superannuation scheme available.

Write full details—Box 3125.

A SMALL progressive firm north of London need the help of an engineer having good practical and technical experience in armature winding, design and re-design of A.C. and D.C. rotating machines, transformers, control gear, etc. This vacancy would suit an engineer wishing and able to take the responsibility of seeing his own jobs through the various stages. Good salary and prospects. All replies treated in strict confidence.—Box 3255.

ADDITIONAL supervising engineer for London contractor. One able to run contracts from inception to final accounts and be responsible to manager for same. Only person who has had several years' experience in similar capacity would suit. Good salary and prospects. —Box 106.

APPLICATIONS are invited for the position of production technical assistant in a North London lamp making company. Minimum qualification required O.N.C. (Electrical) or equivalent. A permanent position offering an excellent opportunity for a man of initiative and ambition. Write stating age, qualifications, experience, present salary, to—**Box 3139.**

BOOK-keeper, male or female. This is a responsible position and a good salary will be paid. Please state present earnings and when available. References would be required. —Box 107.

ELECTRIC cable makers require experienced representative for Yorkshire area. Salary plus commission give above average earnings, with ample scope for improvement. Preference will be given to applicants having previous experience in the electric cable making industry and a knowledge of the radio and television industry would be an added advantage. Car provided. Pension scheme. Apply in strict confidence to—Sales Director, Permanoid Limited, Manchester, 4. 3251

ELECTRICAL contractors require a deputy for the contracts manager. Should be capable of supervising medium size contracts and have knowledge of estimating. Salary £950 per annum, free pension scheme. Apply in writing to—Signal Service (Contracting) Ltd., 461, Uxbridge Road, Hatch End, Middx. 8408

ELECTRICAL contractors require experienced storekeeper. Must have knowledge of trade. Opportunity for right man to join expanding firm. — Service Electric Co. Ltd., Secomak Works, Honeypot Lane, Stanmore, Middx. (EDGware 5566). 3140

ELECTRICAL engineer required at Southern Outfall Works, Belvedere, Kent, to assist in supervising the erection and commissioning of H.V. and L.V. plant including switchgear and comprehensive lighting, heating and power installation. Up to £1,125 according to qualifications and experience. Form from Chief Engineer (GS/R/3346/12), L.C.C., County Hall, London, S.E.1. 3249

ELECTRICIANS very urgently required. London rates. Contract work.—Leonard J. Ive Ltd., 29, Clarendon Road, Watford (Telephone 29626). 3259

ESTIMATING/supervising and/or design and also junior engineer required for progressive positions for high-class installation work in an expanding company. Write in confidence stating age, experience in detail and salary required to—Managing Director, Alliance Electrical, 2, Henrietta St., London, W.C.2. Progressive salary and scope for advancement for able and enthusiastic engineers. 137

ESTIMATOR and supervisor required for electrical contractors' office in London. Good salary and prospects for man having the right experience.—Box 3252.

EXPERIENCED representatives, with contracting and user connections in South London, are required by a rapidly expanding electrical wholesaler. Successful applicants will be chosen by the 12th of February, 1962. Write in confidence giving age, education and experience to—Box ER.7660, c/o Whites, 72, Fleet Street, London, E.C.4. 219

EXPERIENCED storekeepers required. Superannuation. Apply giving full details of past experience, age, etc., etc., to—Branch Manager, Edmundsons Electrical Wholesalers Ltd., 24/30 Gillingham St., London S.W.1. 3253

HALSEY'S ELECTRIC Co. Ltd., Brandon House, Wyfold Road, Fulham, London, S.W.6, require sales order clerk of ability who has had previous experience in a similar capacity in the electrical industry. This is a permanent position with a commencing salary of up to £800 per annum. Canteen facilities, pension scheme and excellent working conditions.—FULham 3355. 3214

JOINTER (extra high tension) required. Present rate of pay 66.75d. per hour. N.J.I.C. conditions, including 42-hour 5-day week, holiday and sick pay schemes. Optional superannuation scheme. Apply by letter stating age, details of past experience and present position to District Manager, Midlands Electricity Board, Brunswick Terrace, Stafford. 3204

JUNIOR technical assistant, age 20-28, for preparation of lighting schemes, illuminating engineering dept. manufacturers of lighting equipment. 5-day week. Pension fund. Apply stating experience to—Chief Engineer, Technical Service Dept., Holophane Ltd., Elverton Street, Westminster, London, S.W.1. 3058

PRODUCTION superintendent required by Permali Ltd., Gloucester, for Cast Epoxide Resin Division, manufacturing insulation for heavy electrical industry. Experience of controlling labour and of batch production of a technical product essential, although not necessarily in this material. Applications to the Secretary, Gloucester. 3184

SALES clerk required for order office. Apply giving full details of experience, age, etc., to—Branch Manager, Edmundsons Electrical Wholesalers Limited, 24/30, Gillingham Street, London, S.W.1. 3254

SENIOR contracts engineer required by large Manchester electrical contractor. Age group 35-45, with minimum qualifications H.N.C., sound practical training in heavy industrial contracts and wide experience in all forms of electrical installation work. Applicants should have proved experience of contract managements, estimating and labour control. Excellent prospects for man of energy, courage and initiative. Please apply in writing giving full details including salary expected, to—Box 3221.

TECHNICAL sales engineer for London and Southern England. Age 24-40. Training and experience in electrical/electronic engineering and a general knowledge of electrical engineering industries in the South essential. Outside commercial experience and H.N.C. (Elec.) desirable. Straight salary will be paid, plus expenses, and a car will be provided. Rented (non-tied) accommodation available. Write in confidence to the Personnel Manager, Standard Telephone & Cables Limited, Rectifier Division, Edinburgh Way, Harlow, Essex. 3198

TECHNICAL sales engineer possessing O.N.C. or H.N.C. (Elec.), trained in control gear circuitry and having some experience of electric motors. After further training the successful applicant will be responsible for the negotiation of contracts with customers, installation and commissioning equipment on customers' premises. Applicants, aged 21-30, must be prepared to travel outside the London area as and when required. Apply stating age, experience, qualifications and present salary to Fuller Electric Limited, Fulbourne Rd., London, E.17. 3189

TEST station engineer required by an established and progressive company situated in the Birmingham area. The successful candidate will initially be responsible for the installation of testing and recording equipment in a new medium-sized short circuit testing station of 10 MVA capacity and, when the plant is commissioned, will have every prospect of becoming station manager. Applications are invited from men having a science degree or at least H.N.C., and also from chartered electrical engineers. In addition a sound knowledge of short circuit and overload testing conditions to meet British standards for low and medium voltage fuses, switchgear, contactors and circuit breakers is necessary. Applications giving details of age, qualifications and previous experience should be addressed to Personnel Manager.—Box 3213.

YOUNG supervising engineers required for installation department of leading South Coast electrical engineers.—Box 3190.

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may be suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

ADVERTISER seeks position. Experienced in outside sales representation and sales office. Good knowledge of electrical trade. Used to estimates and quotations in the switchgear field, dealing with consultants, architects. Own car.—Box 8402.

A.M.I.E.E. (47), at present general manager with small firm, seeks new post. Formerly with both medium and very large firms in managerial capacity. Medium and light engineering (not electronics as yet), covering design and sales in wide aspects of heating, lighting, control panels, site supervision, etc. References will confirm loyalty, balanced judgment, hard worker and value generally. Resident London. Min. starting salary £1,500.—Box 8406.

BRANCH manager (36) with national firm of contractors, 10 years' estimating experience, seeks change. Prepared to consider moving to any part of country for progressive firm with the right future to offer.—Box 8410.

CLASSIFIED ADVERTISEMENTS
ARE PREPAID

ELECTRICAL engineer (40), H.N.C., A.M.A.S.E.E. Exp. industrial plants contracting, home and abroad. Position preferred Europe or overseas. Fluent German spoken.—Box 8399.

ENERGETIC man, early thirties, only interested in a modern forward-thinking organisation in the electrical field, seeks a position as a sales manager. Qualifications, enthusiasm, ability. Grad. I.E.E.—Box 8400.

SALES executive, with first-class live connection amongst wholesalers and retailers in the electrical and radio trade in the West of England and Wales, including supervision of Bristol depot, seeks new position. Excellent sales record, top contacts, able administrator.—Box 8409.

ARTICLES FOR SALE

ELECTRO MOTION LIMITED

offer from their extensive stock :—

BRAND NEW "Chorehorse" Portable Lightweight Petrol-driven Alternating Sets, 225 watts, 230 volts, single-phase, 50 cycles A.C., electric and rope start, comprising single-cylinder, 4-stroke air-cooled petrol engine, direct coupled to alternator with control panel. With spares and complete set of tools. Separate battery charging output.

IDEAL FOR TELEVISION, RADIO, IN BOATS, CARAVANS, HOUSES, etc.

PRICE £49 each ex works.

312.5-watt VILLIERS/EDC Petrol-driven Portable Alternating Sets, comprising Villiers Mark 10 single-cylinder, 4-stroke, 1.3-h.p. air-cooled petrol engine, belt driving EDC alternator, 230/1/50, A.C., 3,000 r.p.m., .9 power factor, self-exciting. On light bed plate.

IDEAL FOR TELEVISION, RADIO, etc. 1.2 amps. First-class condition.

PRICE £35 each ex works.

Write for photographs and stock lists containing generators, diesel engines, electric motors, tractors, etc., to :—

ELECTRO MOTION LIMITED
Barkby Road, Leicester
(Tel. 66341, 5 lines)
305

UNUSED ALTERNATORS FOR SALE

Frustrated Exports

	kW	r.p.m.		
One	130	600/720	3ph./50/60cy.	380 v.
Two	132	720	3ph./60 cy.	380 v.
One	346	600	3ph./50 cy.	415 v.
One	310	750	do.	do.
Four	110	600	do.	400/440v.
Three	225	600	do.	3.3/6.6kV
Three	620	750	do.	3.3 kV

All single-bearing machines for direct coupling. Makers' guarantee. Very low prices.

FYFE, WILSON & CO. LTD., Engineers
Bishop's Stortford, Herts
(B.S. 1000/1/2)
162

ELLISON BANTAM STARTERS

54 S.D. Oil-immersed Starters (unused).
33 D.O. Oil-immersed Starters (unused).
All with isolators, legs and ammeters.

HORROCKSES, CREWDSON & CO. LTD.
Preston, Lancs.
297

HOUSE SERVICE METERS

200-240-v. A.C. or D.C., 10 amps. capacity, quarterly type, from 25s. each, plus 2s. 6d. carr.

UNIVERSAL ELECTRICAL CO.
221, City Road, London, E.C.1 37

Articles for Sale (continued)

WESTINGHOUSE

BATTERY CHARGERS available for immediate delivery from stock — wide range of models to suit requirements of industry. Write for leaflet 13.BC.10, or for urgent attention telephone London Terminus 6432, Birmingham Midland 5507, Manchester Deansgate 3664, Glasgow Central 1520 or Newcastle 23181.

WESTINGHOUSE BRAKE AND SIGNAL CO. LTD · 82 YORK WAY, LONDON N1

208

A.A. ELECTRICAL Co. for A.C.-D.C. motors, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—CHI. 5105. 67, Rothschild Rd. London W.4. 57

A.C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5566/9). 91

A.C. and D.C. slotmeters and quarterlies. Reconditioned, gauranteed 2 years. Repairs and recalibrations.—Victor Electric Co., South View, Sweet Hill, Patcham, Brighton, Sussex. 8336

ALTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 600 kVA.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (CLErkenwell 5512). 24

ALTERNATORS and generators, all types up to 150 kW.—Powerco Ltd., 312, York Road, London, S.W.18 (VAN. 5234). 151

BARGAINS in electric motors from A. Cooksley & Co. Ltd., 21/25, Tabernacle Street, London, E.C.2. Ring Monarch 3355. 50

BRAND new and unused, ex makers' works: 6 off 1,100-amp. and 15 off 300-amp. type "E" Ellison circuit breakers, ex-stock delivery. Apply — Slaters Electricals Ltd., T.V.T.E., Gateshead, 11. 3085

BRASS lampholders. Standard ½″ B.C.s.c. and ½″ pushbar. Competitive prices. Largest stockists in London.—N.L.C., 40, Manchester St., London W.1 (WELbeck 3300). 3199

CABLE, armoured, P.I.L.C., P.V.C., R.I.L.C., V.C.I.L.C. All sizes in stock at our London works. Cutting and delivery same day as order received. Priced stock lists.—Batt Electrical Co., 6, Dock St., London, E.1 (Tel. Royal 5905). 316

CIRCUIT-breakers, various sizes in stock, A.C. and D.C., 200 amperes up to 2,000 amperes. Also dynamo and alternator switchboards. — Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 26

CONVERTERS, motor-alternators, motor-generators, frequency changers, etc. All types up to 100 kW.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 150

CRANE motors. Direct current, series wound or compound wound, all voltages. We have large stocks.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 22

DIESEL generating sets, all sizes to 500 kW. Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 16

ELECTRIC motors, dynamos, alternators and motor generator sets of all sizes. We hold one of the largest stocks in England. New and reconditioned, with 12 months' guarantee.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (Clerkenwell 5512, 3 lines); also Works and Stores, Chobham, Surrey. 20

ELECTRIC motors, generators, motor generator sets, transformers, switchgear, etc., large comprehensive stock, overhauled and guaranteed. Copy of our Register, "Electrical Surplus," containing thousands of items of electrical plant, sent on request.—R. F. Winder Ltd., Belgrave Electrical Works, Leeds, 2. 54

ENGLISH Electric Co. 900-kVA turbo-alternator set with accessories, 415 volts, 3-ph., 50 cycles.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 3086

FLUORESCENT tubes reconditioned and guaranteed with a life as new for 7s. 6d. each. Free collection and delivery in Lancs and Yorks. We are also manufacturers of top quality fluorescent fittings, trunking systems, control gear and new fluorescent tubes. Generous discounts available.—Anglo-American Electrical Company, Olive Street, Bury (Telephone, Bolton 27251). 212

FOR sale, good unused and used machinery including electric motors, A.C. and D.C. dynamos, alternators, transformers, diesel and steam electric generating sets, mains failure sets, motor generator and Ward Leonard sets, switchgear, compressors, fans, capacitors, etc.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford, Herts (Tel. B.S. 1000/1). 161

FRACTIONAL h.p. motors down to 1 r.p. week. 250 Hoover motors always in stock. 11 different ratios of David Brown gear boxes always available means a motorised unit from stock. From—Jearys, 132, East Road, London, N.1. 126

GENERATING sets, portable or stationary, new and reconditioned, 1 to 100 kW, A.C. and D.C. — Powerco Ltd., 312, York Road, London, S.W.18 (VAN. 5234). 148

INSULATING varnish, clear, Minerva No. 720, £10 per 40-gal. drum.—Lowton Metals Ltd., Sandy Lane, Lowton St. Mary's, Leigh, Lancs. (Tel. 71441/2). 93

KARDEX, Roneodex and Shannovue cabinets, as new.—F. H. Jolly & Co. Ltd., 289, King St., London, W.6 (RIV. 5381). 202

MOTOR generator sets and converters, all sizes and voltages from ½ kW up to 500 kW in stock. — Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, City Road, London, N.1 (Tel. Clerkenwell 5512, 5513 & 5514). 12

MOTORS and control gear, huge stocks all types, ¼ to 200 h.p.—Ramsbottom & Co. Ltd., Elec. Engineers, Keighley (5444/7). 70

NAMEPLATES, engraving, diesinking, stencils. — Stilwell & Sons Ltd., 153, Far Gosford Street, Coventry. 108

OFFERS are invited for 6 new Brookhirst 5-h.p., type SC, contactor type, direct-on line starting panels complete with T.P. contactor, solenoid overload trip, interlocked isolator, etc. Full details on application to—Box 3192.

PHASE converters, single to three-phase, several sizes in stock up to 90 h.p., 3-phase loading. — Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 29

PLATING dynamos and motor generator sets, various sizes from 500 amps. up to 2,000 amps., with A.C. and D.C. motors.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 15

POLYPHASE kilowatt hour meters. Available from stock.—Universal Electrical, 221, City Road, London, E.C.1. 40

PREPAYMENT 1s. slot house service meters. —Universal Electrical, 217-221, City Road, London, E.C.1. 36

PURLEY chokes and ballasts. Our 80-w. tapped h.p.f. ballast with starter switchholder incorporated is proving itself the most popular unit. Suitable for most fittings, 57s. 6d. each subject.—F. W. Blanshard Ltd. (Dept. ER), Purley, Surrey (Uplands 4818/9). 52

ROTARY converters in stock, all sizes; enquiries invited. — Universal Electrical, 221, City Road, London, E.C.1. 34

SMALL BR screws and nuts in steel, brass and stainless steel, from stock.—Premier Screw & Repetition Co. Ltd., Woodgate, Leicester. 180

TRANSFORMER, 3kVA (new), 130/230 v., £18; Bridge Megger, 500 v., Evershed, £38; Dynamo panels, 110/200 v., 300 amps. D.C., two, £18 ea.; Kohler armature, 110 v., 800 watts, complete, £15. — E. Binns, Engr., Withens, Osgodby, Scarborough. 8411

VENNER time switches, 200/240 v. A.C./D.C., 10-50 amps., from stock.—Universal Electrical Co., 221, City Rd., London, E.C.1. 38

WARD Leonard motor generating sets, all sizes.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1 (Tel. Clerkenwell 5512). 10

WELL glass fittings, 60 watts, enamelled, 50/60 for sale. Offers.—Box 3222.

ZENITH Variac transformers, 5-7 kVA, 230 v. A.C., s/ph., 50 c. input, 0-270 v. A.C., s/ph., 50 c. output. £39 10s.—Universal Electrical Co., 221, City Rd., London, E.C.1. 3200

400-cycle to 1,500-cycle motor alternators and alternators.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 27

500-kW, 220-volt Met.-Vick. rotary converter, with transformer, 11,000 volts, 3-phase, 50 cycles, and accessories.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 17

EQUIPMENT FOR HIRE

ALTERNATORS and lighting sets, 3 kW to 75 kVA, A.C. or D.C., for hire; also welding sets, 3/400 amps.—Reeds Cranes & Plant Ltd., Newcastle/Tyne (Tel. 33311). 2997

GENERATING set hire service. Consult the most experienced firm for A.C. and D.C. units from 2 kW to 240 kW, diesel or petrol, stationary or mobile, sale or hire, 24-hr. breakdown service. — Dawson-Keith Ltd., Hillview Rd., Sutton, Surrey (Fairlands 4401). 46

ARTICLES WANTED

WANTED

D.C./A.C. Motors, Transformers, Cables and all redundant Power Station plant wanted for dismantling.

ASK US TO QUOTE.

B. M. T. CO. LTD.
London Road, Barking
(RIP. 3387/3715)

298

WANTED FOR CASH

SURPLUS Diesel Generating Sets, all sizes up to 1,000 kW. We dismantle and remove.

DAWSON-KEITH LTD.
Hillview Road, Sutton
(Fairlands 4401/2/3) 47

QUICKSILVER and beryllium copper scrap urgently required, best prices, prompt cash. Sterling Products Ltd. Edmonton 4541 PBX. 293

URGENTLY required: Surplus electrical steel sheets, minimum size 60″ × 30″ and up. Thickness .014 and .018.—Box 3215.

WANTED, D.C. and A.C. ball-bearing motors, motor generator sets, dynamos and alternators. Full details to — Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1. 13

WANTED for prompt cash, ferrous and non-ferrous scrap, also plant for dismantling. Buyers of secondhand machinery and plant for re-use.—W. & H. Cooper Ltd., 176, Brady St., Bethnal Green, London, E.1. 120

WANTED, Isenthal voltage regulators, also capacitors for industrial use.—Fyfe, Wilson & Co. Ltd., Station Wks, Bishop's Stortford. 3256

WANTED, rotary converters, any sizes.—Universal, 221 City Rd., London E.C.1. 35

WANTED, surplus stock cable, all types and sizes. We can inspect.—Box 220.

WORK WANTED AND OFFERED

A.C. and D.C. motor rewinds and repairs. Prompt service, fully guaranteed.—Edgware 5566/9; Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. 92

ELECTRICIAN (semi-retired), own workshop facilities, seeks assembly or other appropriate work; lowest charges.—Box 3191.

EXPERIENCED engineer prepares estimates or design of electrical installations for contractors, consultants or architects. Send for brochure.—Box 8401.

PRODUCTION winding of armatures, stator, coils, transformers. Also special motors. Prompt and reliable deliveries.—Lewis Electric Motors Ltd., Moor Wks., Maidenhead, Berks. 194

AGENCIES

AGENCIES required by electrical sales manager starting own agency. Propositions sought from companies requiring representation London/South. Well connected with industry and consulting engineers. Full information to —Box 8398.

AGENTS most areas to sell to industry, in particular large electrical engineering concerns, a considerable range of accessories. Limited competition, good commission. Only applicants with first-class connections need apply.—Box 3223.

ELECTRICAL Appliances Division of old-established manufacturing group requires agent possessing sound connections with electricity boards and domestic distribution trade generally, to cover London, Home Counties and Eastern Counties. Lines at present in production include coal effect fires (freestanding and hearth models), to be shortly followed by a continually widening range of heating appliances. Agency representation will be permanent. Applicant should state age, territory and nature of lines at present carried.—Box 3201.

TO manufacturers: Live representation in London and Home Counties offered by experienced and established agent with substantial connections, who has capacity for a guaranteed product applicable to wholesalers, electricity boards and the industrial field.—Box 3141.

BUSINESSES FOR SALE AND WANTED

COMPANY with agreed tax losses wanted. Electrical merchanting or similar.—Box 8350.

ELECTRICAL conduit fittings. U.S. firm wishing to secure foothold in the greater Common Market seeks to buy control of a small to medium-sized British firm (about 70 employees) in this field. Write first, in confidence, to—James Buckley & Company, Licensing Consultants, 2, Hyrons Lane, Amersham, Bucks. 3130

PATENT NOTICES

THE proprietor of Patent No. 658869 for "Finger type circuit regulator" desires to secure commercial exploitation by licence or otherwise in the United Kingdom. Replies to Haseltine Lake & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.2. 3258

THE proprietors of Patent No. 716469 for "High frequency coil assembly" desire to secure commercial exploitation by licence or otherwise in the United Kingdom. Replies to Haseltine Lake & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.2. 3257

EDUCATIONAL

CITY and Guilds (Electrical, etc.) on "No pass—No fee" terms. Over 95% successes. For details of modern courses in all branches of electrical engineering, applied electronics, automation, etc., send for our 148-page handbook—free and post free.—B.I.E.T. (Dept. 12a), 29, Wright's Lane, London, W.8. 100

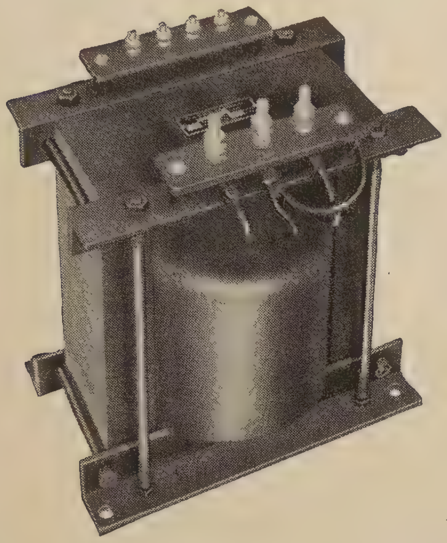
BOOKS, INSTRUCTIONS, ETC.

"ABACS or Nomograms," by A. Giet. Translated from the French by H. D. Phippen and J. W. Head. Most engineers have made use of nomograms at some time in their careers, and are fully alive to the fact that they are a very convenient tool when the same formula has to be solved repeatedly for several sets of variables. It is fair to say, however, that only a small proportion of even those who habitually employ nomograms know how to construct them for their own use. Most of the comparatively small literature on the subject is written for mathematicians and is extremely difficult for the practical engineer to comprehend. This book is essentially practical, and not only demonstrates the many and varied applications of the abac or nomogram, but shows how even those without highly specialised mathematical knowledge may construct their own charts. 35s. net from all booksellers. By post 36s. from the publishers: Iliffe Books Ltd., Dorset House, Stamford Street, London, S.E.1. C3

Insist on

T.E.C.

ELECTRONIC CONTROL EQUIPMENT, POWER AND DISTRIBUTION TRANSFORMERS TO 100 kVA, LOW VOLTAGE, FLASH TEST, RECTIFIER AND DENTAL PLATING UNITS, METAL WORK, TRANSFORMER REPAIRS AND CHOKES



Leaflets on request:—

NSC. TYPE
1500 V.A. TO 4000 V.A.

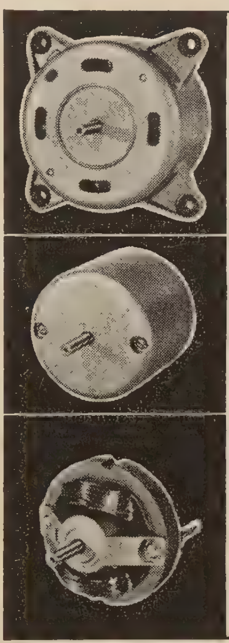
The
TRANSFORMER & ELECTRICAL CO. LTD.
HONYWOOD RD., BASILDON, ESSEX
Telephone: Basildon 20491/3

---

cassor

HIGH QUALITY

Fractional horse-power electric motors



1-20 watts output for

fan units — heaters — projectors — cooling equipment — tape recorders record players, etc.

Geared Motors for special applications

Silent running with self lubricating sintered bronze bearings

A Variety of fixings with open, semi-enclosed or enclosed housings

Comprehensive Catalogue forwarded on request

Sole distributors:—

CASSOR ELECTRIC MOTORS LTD.
10 BURY PLACE, NEW OXFORD ST., LONDON, W.C.1. Tel.: CHAncery 4606

LAPLACE TRANSFORMS FOR ELECTRICAL ENGINEERS

By B. J. Starkey, DIPL. ING., A.M.I.E.E.

A presentation of the theory of Laplace transformation in which a physical vocabulary rather than a purely mathematical one is used as far as possible. This method of analysis has become of increasing importance to electrical engineers in many fields, and the work is designed to provide a thorough treatment of the subject in a language with which they will be familiar.

30s. net. BY POST 31s. 2d.

From booksellers. Published by:

ILIFFE Books Ltd Dorset House Stamford St London SE1

ELREMCO

"STAR" TIMER

A SHINING EXAMPLE OF DIAL TYPE AUTOMATIC TIMER

(Some Time Ranges Ex-stock)

MANY EQUALLY BRILLIANT MULTI-CIRCUIT, CONTINUOUS CYCLE AND RESETTING CAMSHAFT MODELS ALSO AVAILABLE, ASK FOR LITERATURE

ELECTRICAL REMOTE CONTROL CO., LTD.
BUSH FAIR, HARLOW, ESSEX. Phone 24285

Modern Electrical Contracting

How does one establish a footing in the ever-widening field of electrical contracting? More important—how does one become an efficient, well-organized contractor with a flourishing business and a reputation for good service?

This book by H. R. Taunton, A.M.I.E.E., gives all the facts in great detail. Every phase of contracting work is covered, from the first steps in founding or taking over a business, to a penetrating examination of what the future holds for the industry.

The technicalities of electrical installation work are not discussed. “ Modern Electrical Contracting ” deals solely with the commercial side of a contracting business: its organization, economics, staff, premises, equipment, stores, stock, accounting, advertising and daily routine. Its value to the ambitious newcomer in the field needs no emphasis, but every established contractor would also do well to read and re-read it.

contents include

How to Begin : The Office Staff : Obtaining Orders : Advertising
Correspondence and Filing : Dealing with Inquiries : The Technical Side
Estimating : Orders : Material and Plant : Stores and Stock : Labour
Work in Progress : The Future of the Industry : Index

PUBLISHED FOR ELECTRICAL REVIEW

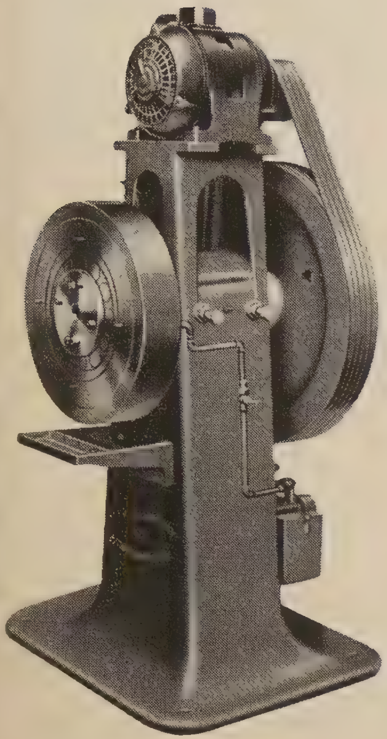
10s. 6d. net. By post 11s. 4d.

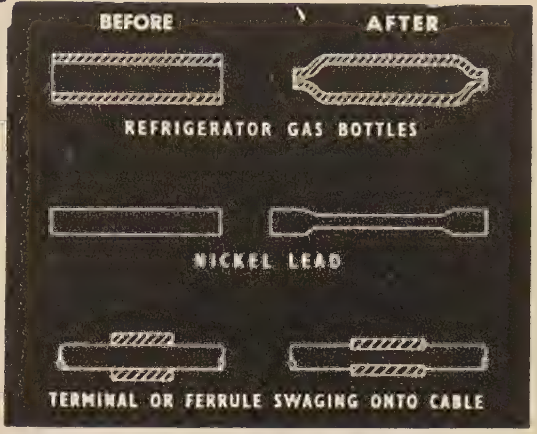
OBTAINABLE FROM ALL BOOKSELLERS. PUBLISHED BY:—

ILIFFE Books Ltd Dorset House Stamford St London SE1

Can ROTARY SWAGING help YOU?

Examples of the type of work for the ELECTRICAL TRADE





SAVE MONEY TIME AND MATERIAL

- No wastage of material
- Operated by unskilled labour
- Cheapest and Quickest method

Rotary Swaging is a means of reducing, tapering or pointing rod, tube and wire, and is essentially a hammering operation, the rapidity of the blows producing a fine finished surface, toughening the material and increasing its tensile strength. It is used extensively for electrical elements, and is better for manipulating tungsten, molybdenum and nickel.

SEND FOR FULL PARTICULARS—***It might solve your problem***

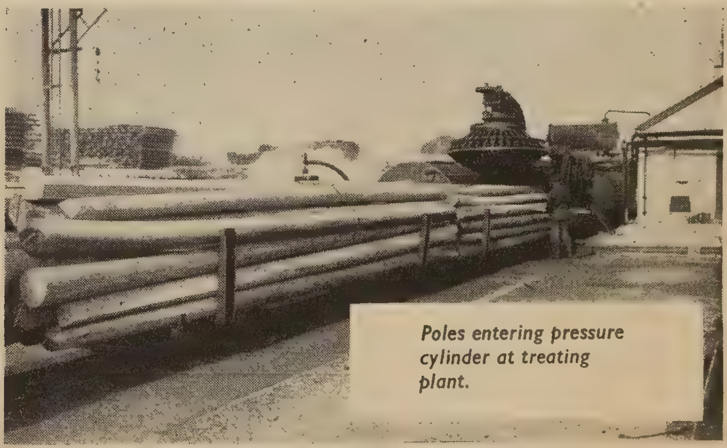
STEVENS & BULLIVANT LTD.
Western Road · BIRMINGHAM 18

Telephone:
NORthern 4514/5 and 0236
Telegrams:
"Swager, Birmingham"

THE TEST OF TIME

For more than a century, Burt Boulton & Haywood Ltd. have maintained their leadership in the timber preservation field. For his pioneer efforts as early as 1853, Mr. H. P. Burt was honoured by the Institute of Civil Engineers. Today's experts favour pressure impregnation with Creosote for Telegraph/Transmission Poles and timber in contact with the ground. In the final analysis, it is the supreme test of time on the treated wood that really counts. This is where Burt Boulton & Haywood leave nothing to chance. Their scientific methods have been successfully tried and tested for decades.

- **A CENTURY'S EXPERIENCE** guides today's experts in preservation.
- **MODERN WORKS** extensively equipped to serve your needs.
- **METICULOUS CONTROL** maintained throughout all stages of treatment.



Poles entering pressure cylinder at treating plant.

Burt Boulton & Haywood Ltd

PRESERVATION FACILITIES AT: Belvedere (Kent), Eling (near Southampton), Newport (Mon.) and West Hartlepool
HEAD OFFICE: Brettenham House, Strand, London, W.C.2. Tel: Temple Bar 5801

Advance Components Ltd. 9
Airscrew Co. & Jicwood Ltd. 33
Allen, W. H., Sons & Co. Ltd. 87
Allen West & Co. Ltd. 3
Anglo-American Vulcanized Fibre Co. Ltd. 11
Appelbe, J. F., & Co. Ltd. 70
Arrow Electric Switches Ltd. 45
Ascot Lamps & Lighting Ltd. 60
Asquith Electrics (Colne) Ltd. 89
Associated Electrical Industries Ltd. 5 & 18

Backer Electric Co. Ltd. 44
Barns, W., & Son (Holloway) Ltd. 26
Belling & Lee Ltd. 36
Birmingham Specialities Ltd. 72
Boxall, T. A., & Co. Ltd. 90
Brentford Transformers Ltd. 63
Bridge, David, & Co. Ltd. 66
Briscoe, W. H., & Co. Ltd. 60
British Brown-Boveri Ltd. 57
British Driver-Harris Co. Ltd. 43
British Electrical Repairs Ltd. 72
British Insulated Callender's Cables Ltd. 35
British Klockner Switchgear Ltd. 80
Bryce Electric Construction Co. Ltd. *Cover 3*
Bulgin, A. F., & Co. Ltd. 78
Bullers Ltd. 65
Bulpitt & Sons Ltd. 8
Burt Boulton & Haywood Ltd. 103

Carr, James W., & Co. Ltd. 80
Cassor Electric Motors Ltd. 101
Channel Conduits Ltd. 54
Chilton Electric Products Ltd. 17
City Electrical Co. 106
Connollys (Blackley) Ltd. 4
Contactor Switchgear Ltd. 32
Cressall Mfg. Co. Ltd. 78
Critchley Bros. Ltd. 24
Crompton Parkinson Ltd. 81

Donovan Electrical Co. Ltd. 106
Dorman & Smith Ltd. 6
Downes & Davies Ltd. 74
Drummond, John (Engineers) Ltd. 26

E.C.C. (Moulded Breakers) Ltd. *Cover 2*
E.M.P. Electric Ltd. 46
East London Mica Works 26
Electrical Remote Control Co. Ltd. 101
Electro Mechanical Mfg. Co. Ltd. 10
Enfield-Standard Power Cables Ltd. 12
Engel & Gibbs Ltd. 29
English Electric Co. Ltd. 21 & 56

Fan Disc Ltd. 19
Fawcett Preston & Co. Ltd. 49
Ferranti Ltd. *Cover 1*
Field & Grant Ltd. 54
Fitter & Poulton Ltd. 86
Fractional H.P. Motors Ltd. 78
Fuller Electric Ltd. 13

G.W.B. Furnaces Ltd. 58
General Electric Co. Ltd. *Cover 4* & 64
Gent & Co. Ltd. 14
Glover, Stephen, & Co. 104
Griffiths, Gilbart, Lloyd & Co. Ltd. 82

Hampton Works (Stampings) Ltd. 90
Henley Burrowes & Co. Ltd. 72
Higgs Motors Ltd. 37
Holophane Ltd. 47

Iliffe Books Ltd. 86 & 102
Imperial Chemical Industries Ltd. 25
International Combustion Ltd. 16
International Rectifier Co. (G.B.) Ltd. 55
International Synthetic Rubber Co. Ltd. 62
Ismay Lamps Ltd. 19

Johnson, Matthey & Co. Ltd. 92
Johnson & Phillips Ltd. 61

Kempston Electrical Co. Ltd. 86
Kenwood Mfg. (Woking) Ltd. 22

Lancashire Dynamo Electronic Products Ltd. 79
Laurence, Scott & Electromotors Ltd. 1
Litholite Insulators & St. Albans Mouldings Ltd. 66
Londex Ltd. 90
Lumitron Ltd. 32

M. & C. Switchgear Ltd. 50
M.K. Electric Ltd. 52
Maclaren, Robert, & Co. Ltd. 20
Martindale Electric Co. Ltd. 30
Measuring Instruments (Pullin) Ltd. 28
Mek-Elek Engineering Ltd. 76
Mercury Switch Mfg. Co. Ltd. 72
Metropolitan Tool & Products Ltd. 76

Neill, James, & Co. (Sheffield) Ltd. 44
Nife Batteries 2
Non-Ferrous Die Castings Co. Ltd. 34

Oberterm Electrical Co. Ltd. 80
Oddie, Bradbury & Cull Ltd. 76
Otter Controls Ltd. 84

Parsonage, W. F., & Co. Ltd. 106
Parvalux Electric Motors Ltd. 74
Philips Electrical Ltd. 105
Preformed Line Products (G.B.) Ltd. 42
Pyrotenax Ltd. 51

Rawlplug Co. Ltd. 23
Renold Chains Ltd. 67
Revo Electric Co. Ltd. 68 & 69
Reyrolle, A., & Co. Ltd. 31
Rheostatic Co. Ltd. 41
Rowlands Electrical Accessories Ltd. 83
Runbaken Electrical Products 86

Salford Electrical Instruments Ltd. 19
Service Electric Co. Ltd. 106
Sheen (Nottingham) Ltd. 70
Sheffield Twist Drill & Steel Co. Ltd. 38
Shell Chemical Co. Ltd. 39
Simmonds Bros. 30
Simon-Carves Ltd. 71
Simplex Electric Co. Ltd. 40
Sims, F. D., Ltd. 104
Smiths Clocks & Watches Ltd. 73
Standard Telephones & Cables Ltd. 85
Stevens & Bullivant Ltd. 103
Sturdy Electric Co. Ltd. 66
Sturtevant Engineering Co. Ltd. 7
Sulzer Bros. (London) Ltd. 27
Symonds, R. H., Ltd. 24

Tetra Engineering Co. Ltd. 82
Thompson Bros. (Engineers) Ltd. 104
Thorn Electrical Industries Ltd. 48
Thorpe, F. W., Ltd. 75
Transformer & Electrical Co. Ltd. 101

Universal Electrical Co. 106

Varilectric Ltd. 59
Vernier Mfg. Co. Ltd. 30
Volex Electrical Products Ltd. 91

Wandleside Cable Works Ltd. 77
Webber, R. A., Ltd. 80
Weekes, L. (Luton) Ltd. 70
Westminster Engineering Co. Ltd. 76
Wheeler, F. H., & Co. Ltd. 30
Wiggin, Henry, & Co. Ltd. 88
Wootton & Co. Ltd. 29

Zenith Electric Co. Ltd. 15

MODEL No. 5

"STEPHEN GLOVER"
INFRA RED
AND
RADIANT HEAT
HEALTH LAMPS
AND
ULTRA VIOLET
SUN LAMPS

Illustrated Lists on request

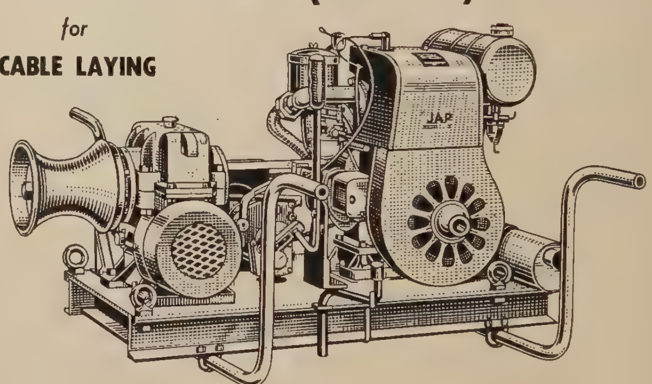
Infra Red
Specialist
Manufacturers

STEPHEN GLOVER & CO.
INTOWN • • WALSALL
Phone: Walsall 22988

ENAMELLED
H.C. COPPER WIRES
ON L.T.V. REELS

. . . a product of **F.D. SIMS LIMITED**

P.O. Box 8, Hazelhurst Works, RAMSBOTTOM, Via Bury, Lancs.
Telephone: Ramsbottom 2213/4/5 *Telegrams:* "SIMS" Ramsbottom
London Office and Stores:
106 Newlands Park, Sydenham London S.E. 26
Telephone: SYDenham 4211/2
S.60



THOMPSON
1-TON PULL WINCH (Model 39)
for
CABLE LAYING

The Model 39 is ideal for trench cable pulling work with its capacity of 1-ton pull at 45 ft per minute. The winch has been designed with 4 lifting handles for ease of man-handling on site and is powered by a 4½ h.p. J.A.P. petrol engine, as illustrated, or a Villiers diesel engine. A 3-speed forward and reverse gear box together with clutch is fitted to the winch which is priced at £220 0s. 0d. Ex Works.

Write for full details to:

THOMPSON BROS.
(ENGINEERS) LIMITED
ARCHERY WORKS • ARCHERY RD • ELTHAM • LONDON, S.E.9
Telephone: ELTham 5522/3

PHILIPS
big new profits are taking shape

The mushroom look in lamps has caught on — fast. Sales of Philips 'K' Lamps are rising on the wave of demand. Philips 'K' Lamps are smaller. Smarter, too. So much more compact. Elegant lamps for today's new light fittings. There's another good reason why they sell. Philips world-wide reputation for dependability. Stock Philips 'K' Lamps, Put them in your window. You'll find them profitable — very!

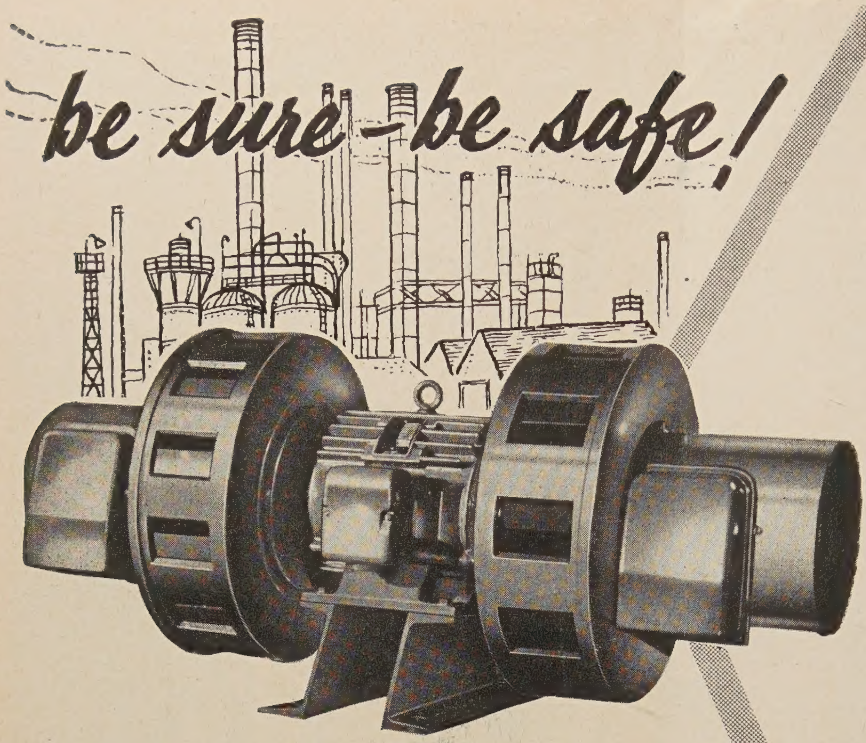
PHILIPS 'K'
MUSHROOM LAMPS

60w. **2/0½d.** 100w. **2/0½d.** 150w. **2/8.** *(all inc. P. Tax)*

Philips lead the world in lighting

PHILIPS

Philips Electrical Ltd., Lamp and Lighting Group, Century House, Shaftesbury Ave., London, W.C.2.


be sure-be safe!

The Secomak REGD

ELECTRIC SYREN

is the most dependable

This Secomak Coded Type is a multi purpose syren of outstanding merit, e.g. in case of fire it will give an arresting alarm of a completely different character to the works time signal that it makes daily.

We make several other types and will be pleased to advise on the selection of the most suitable for your purpose.

Send for Data Sheet No. 250

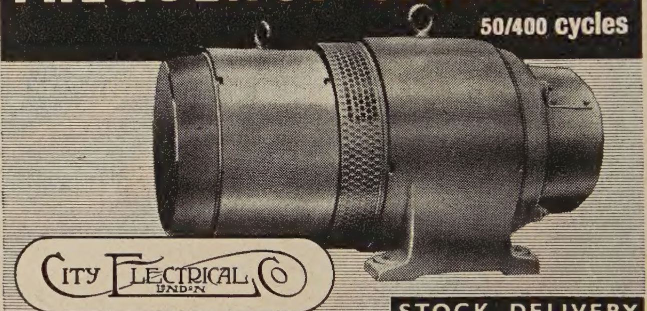
SERVICE ELECTRIC CO. LTD. HONEYPOT LANE · STANMORE · MIDDX. *EDGware 5566/9*

INDUCTA
A.I.D. Approved

TRANSFORMERS of all types up to 25 KVA for Single or Three phase operation. Phase conversion, etc.
MAINS, Output and Special Purpose Transformers for Radio Equipment, Chokes, etc.
COILS for Contactors, E.M. Brakes, Air Valves, etc., and **COIL WINDINGS** for all purposes.
SOLENOIDS for A.C. and D.C. Operations.

W. F. PARSONAGE & Co. Ltd.
INDUCTA WORKS
Fryers Road, Bloxwich, Walsall.
Telephone: Bloxwich 76777-8

FREQUENCY CHANGER
50/400 cycles



City Electrical Co London
STOCK DELIVERY
EMERALD STREET, LONDON, W.C.1. HOLBORN 9722

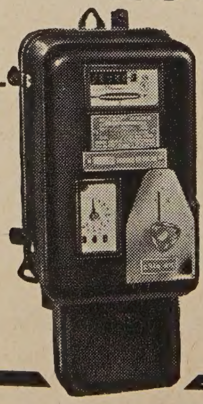
DONOVAN

ELECTRICAL WHOLESALERS

For MOST INDUSTRIAL and DOMESTIC ELECTRICAL SUPPLIES

THE DONOVAN ELECTRICAL CO. LTD.
(WHOLESALING DIVISION)
75-82 GRANVILLE STREET, BIRMINGHAM 1
DAY & NIGHT Tel. No.: MIDland 9441 (13 lines)

HOUSE SERVICE METERS



Credit Pattern
and Prepayment Type
200-240 v. A.C. S/Ph 50c. (& D.C.)
AVAILABLE FROM STOCK
POLYPHASE 400-440 v. 3-wire Type
Ex Stock

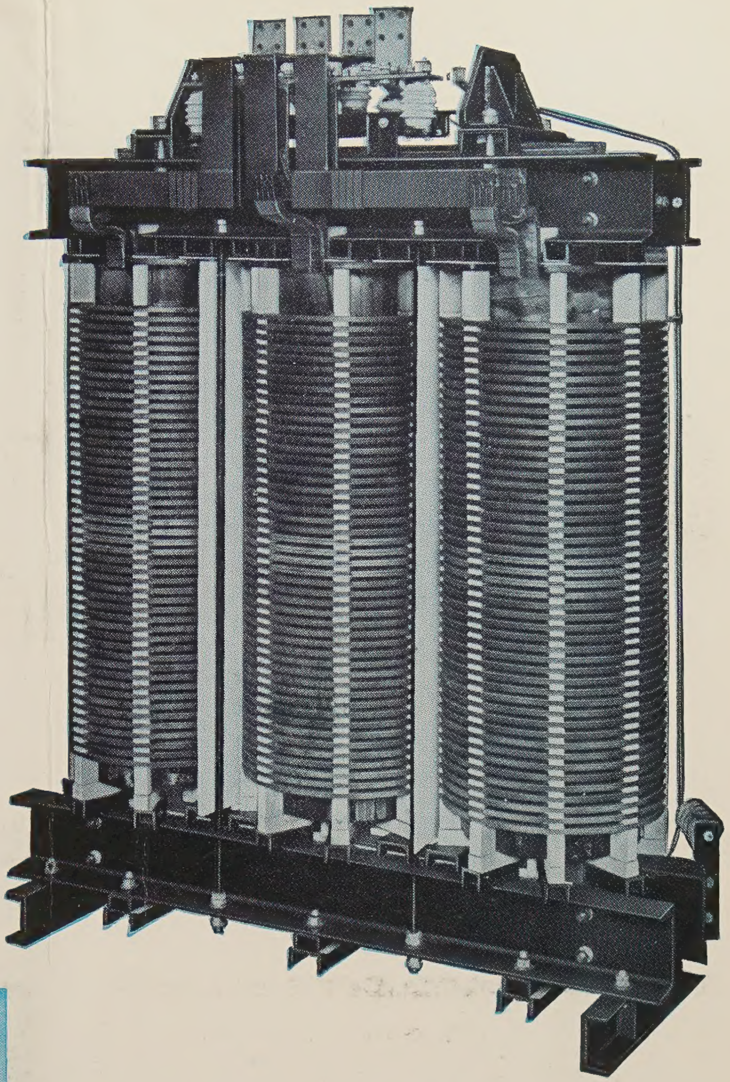
UNIVERSAL ELECTRICAL CO.
217-221 City Road, London, E.C.1

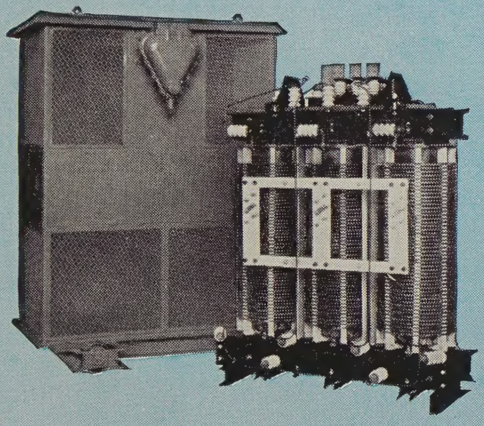
Published by Iliffe Electrical Publications Ltd., at Dorset House, Stamford Street, London, S.E.1
and printed in Great Britain by The Chapel River Press Ltd., Andover, Hants.

BRYCE

SILICONE INSULATION SILICONE INSULATION SILICONE INSULATION

DRY TYPE
AIR COOLED
CLASS-C
TRANSFORMERS





SILICONE INSULATION

- No Fire Risk
- Reduced Weight
- Can be installed in damp locations

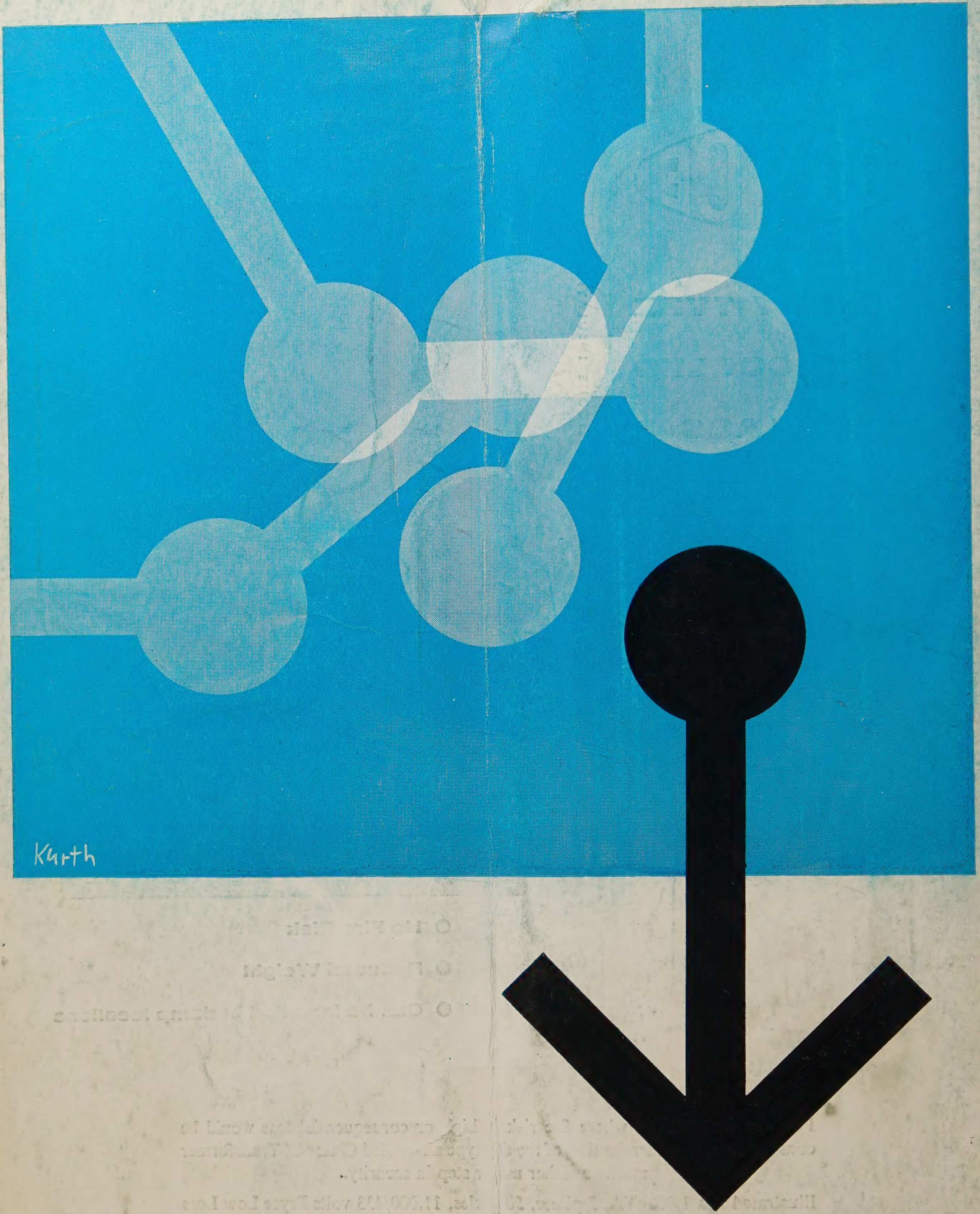
For any installations where fire risk is high or consequential loss would be considerable, the introduction of the dry type air-cooled Class 'C' Transformer marks another major step in security.

Illustrated is a 1,000kVA, 3 phase, 50 cycles, 11,000/433 volts Bryce Low Loss Distribution Transformer using Class 'C' insulation.

BRYCE ELECTRIC CONSTRUCTION CO. LTD.

Kelvin Works, Hackbridge, Surrey. Telephone: FRAnklin 1101-7

Broadway/bec 6



FOR SWITCHGEAR
RELY ON THE EXPERIENCE OF
G.E.C.

G.E.C. (ENGINEERING) LIMITED, Switchgear Division, Birmingham 6